U.S. Department of the Interior
Bureau of Land Management

2023

Environmental Assessment DOI-BLM-NM-P020-2023-0119-EA

Devon Energy Production Company, L.P.

Arena Roja 28 702 and 802

Lease Numbers# NMNM125400

Department of the Interior
Bureau of Land Management
Pecos District
Carlsbad Field Office
620 E Greene Street
Carlsbad, NM 88220
Phone: (575) 234-5972

TABLE OF CONTENTS

1. PURPOSE AND NEED FOR ACTION

1.1. Background

Devon Energy Production Company, L.P. (Devon) has applied for a permit to drill two (2) horizontal oil wells from one (1) new well pads to be constructed on Bureau of Land Management land approximately 12.4 +/- miles southwest of Jal, NM. In the application, Devon is also applying to construct access roads, electric lines and 8” buried composite flowlines/8” composite buried gas lift lines from the well pad to the CTB for the proposed wells. The location of the proposed well(s) are/is as follows:

Arena Roja 28-33	**FED**	**702H**		**Arena Roja 28 Well Pad 2**					
Surface	Section	**28**	T26S,	R35E	250	FNL,	1385	FWL,	Lea County
Bottom Hole	Section	**33**	T26S,	R35E	20	FSL,	1650	FWL,	Lea County
Arena Roja 28-33	**FED**	**802H**		**Arena Roja 28 Well Pad 2**					
Surface	Section	**28**	T26S,	R35E	250	FNL,	1415	FWL,	Lea County
Bottom Hole	Section	**33**	T26S,	R35E	20	FSL,	2310	FWL,	Lea County

Preparing Office:
Pecos District, Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

1.2. Purpose and Need for Action

The purpose for the action is to provide the Devon with reasonable access to develop a federal oil and gas lease.

The need for the action is established by BLM’s responsibility under the Mineral Leasing Act of 1920 as amended, the Mining and Minerals Policy Act of 1970, the Federal Land Policy and Management Act of 1976, the National Materials and Minerals Policy, Research and Development Act of 1980 and the Federal Onshore Oil and Gas Leasing Reform Act of 1987 to allow reasonable access to develop a federal oil and gas lease.

1.3. Decision to be Made

Based on the information provided in this EA, the BLM Field Manager will decide whether to grant the sundry application with appropriate mitigation measures, or whether to reject it.

1.4. Conformance with Applicable Land Use Plan(s)

The 1988 Carlsbad Resource Management Plan, as amended by the 1997 Carlsbad Approved Resource Management Plan Amendment and the 2008 Special Status Species Approved Resource Management Plan Amendment have been reviewed, and it has been determined that the proposed action conforms with the land use plan terms and conditions as required by 43 CFR 1610.5.

Name of Plan: 1988 Carlsbad Resource Management Plan
Date Approved: September 1988
Decision: [Page 10] “In general, public lands are available for utility and transportation facility development…” [Page 13] “BLM will encourage and facilitate the development by private industry of public land mineral resources so that national and local needs are met, and environmentally sound exploration, extraction, and reclamation practices are used.”

Name of Plan: 1997 Carlsbad Approved Resource Management Plan Amendment
Date Approved: October 1997
Goal: [Page 4] "Provide for leasing, exploration and development of oil and gas resources within the Carlsbad Resources Area." The proposed action aids in the development of oil and gas resources and complies with the Surface Use and Occupancy Requirements.

1.5. Relationship to Statutes, Regulations or Other Plans

The following is a list of statutes that may apply to a proposed action:

- **Archaeological and Historic Preservation Act of 1974 (16 USC 469)** - Provides for the preservation of historical and archeological data (including relics and specimens) which might otherwise be irreparably lost or destroyed as the result of (1) flooding, the building of access roads, the erection of workmen's communities, the relocation of railroads and highways, and other alterations of the terrain caused by the construction of a dam by any agency of the United States, or by any private person or corporation holding a license issued by any such agency or (2) any alteration of the terrain caused as a result of any Federal construction project or federally licensed activity or program.
- **Archaeological Resources Protection Act of 1979, as amended (16 USC 470 et seq.)** - Secures, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals.
- **Clean Air Act of 1970, as amended (42 USC 7401 et seq.)** - Defines EPA's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer.
- **Clean Water Act of 1977, as amended (30 USC 1251)** - Establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.
- **Endangered Species Act of 1973 (16 USC 1531 et seq.)** - Protects critically imperiled species from extinction as a consequence of economic growth and development untempered by adequate concern and conservation.
- **Federal Cave Resources Protection Act of 1988 (16 USC 4301 et seq.)** - Protects significant caves on federal lands by identifying their location, regulating their use, requiring permits for removal of their resources, and prohibiting destructive acts.
- **Lechuguilla Cave Protection Act of 1993** - Protects Lechuguilla Cave and other resources and values in and adjacent to Carlsbad Caverns National Park.
- **Migratory Bird Treaty Act of 1918 (16 USC 703-712)** - Implements the convention for the protection of migratory birds.
- **Mining and Mineral Policy Act of 1970, as amended (30 USC 21)** - Fosters and encourages private enterprise in the development of economically sound and stable industries, and in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security, and environmental needs.
- **National American Graves Protection and Repatriation Act of 1990 (25 USC 301)** - Provides a process for museums and Federal agencies to return certain Native American cultural items such as human remains, funerary objects, sacred objects, or objects of cultural patrimony to lineal descendants, and culturally affiliated Indian tribes and Native Hawaiian organizations and includes provisions for unclaimed and culturally unidentifiable Native American cultural items, intentional and inadvertent discovery of Native American cultural items on Federal and tribal lands, and penalties for noncompliance and illegal trafficking.
- **National Historic Preservation Act of 1966, as amended (16 USC 470)** - Preserves historical and archaeological sites.
- **Wild and Scenic Rivers Act of 1968, as amended (16 USC 1271 et seq.)** - Preserves certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations.
- **Wilderness Act of 1964 (16 USC 1131 et seq.)** - Secures for the American people of present and future generations the benefits of an enduring resource of wilderness.

1.6. Scoping, Public Involvement, and Issues

The Carlsbad Field Office (CFO) publishes a NEPA log for public inspection. This log contains a list of proposed and approved actions in the field office. The log is located in the lobby of the CFO as well as on the BLM New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html).
The CFO uses Geographic Information Systems (GIS) in order to identify resources that may be affected by the proposed action. A map of the project area is prepared to display the resources in the area and to identify potential issues. The proposed action was circulated among CFO resource specialists in order to identify any issues associated with the project. The issues that were raised include:

- How would air quality be impacted by the proposed action?
- How would climate change be impacted by the proposed action?
- How would watershed resources be impacted by the proposed action?
- How would soils be impacted by the proposed action?
- How would wildlife/habitat be impacted by the proposed action?
- How would special status species be impacted by the proposed action?
- How would vegetation be impacted by the proposed action?
- Could noxious weeds be introduced to the project area as a result of the proposed action?
- How would range management be impacted by the proposed action?
- How would visual resources be impacted by the proposed action?
- How would cultural resources be impacted by the proposed action?
- How would paleontological resources be impacted by the proposed action?

2. PROPOSED ACTION AND ALTERNATIVE(S)

2.1. Proposed Action

The BLM Carlsbad Field Office is proposing to allow Devon to drill two (2) horizontal oil wells on BLM surface property. The proposed action would also include new access roads, new electric lines and flowlines. In order to drill the proposed wells with a closed loop system four-surfaced well pads would be needed for the wells. Devon would strip the available topsoil from each well pad and stockpile it adjacent to the pad edges as described below in the table. See the table below for pad size description.

Well Pad Name	Pad Size	Sub-Pad Size
Arena Roja 28 Well Pad 2	600’ X 600’	240’ X 270’

Eight inches of topsoil must be reserved to reclaim the pad. The additional topsoil could be used to level the pad before it is surfaced with caliche if the grade meets or exceeds the 6’ minimum elevation change threshold noted in the Interim Reclamation section, per BLM Sundry.

Subsoil would be cleared and stockpiled within the surveyed well site. If caliche is found, material would be stockpiled within the pad site to build the location and road. The well site would then be leveled and surfaced with mineral material, typically the caliche. In the event no caliche is found onsite, caliche would be transported in by trucks from a BLM approved caliche pit or other established mineral pit. The nearest know caliche pit is approximately 1.12 +/- miles northwest from the proposed project.

Location	Topsoil Stockpiles
Arena Roja 28 Well Pad 2	North, Northeast and Northwest Sides

Interim Reclamation

An elevation profile of the entire well pad will be taken to determine if it is feasible to grade and construct only the sub-pad within the larger well pad location, prior to well pad construction. If the Minimum

Elevation Change Threshold that is determined by the elevation analysis does not meet or surpass 6 feet, then the Standard Well Pad Interim Reclamation Procedure, described below, would be executed.

<u>Standard Well Pad Interim Reclamation Procedure</u>
Interim reclamation must be completed or a sundry for variance must be submitted to the CFO within 6 months of well completion, but no later than two years upon approval of the APD's with up to a two-year extension. Final reclamation would occur once the well pad has fully been developed. The sequence of reclamation actions are as follows:

- The areas planned for interim reclamation would then be recontoured to the original contour if feasible, or if not feasible, to an interim contour that blends with the surrounding topography as much as possible. Where applicable, the fill material of the well pad would be backfilled into the cut to bring the area back to the original contour.
- Topsoil would be evenly respread and revegetated over the entire disturbed area not needed for all-weather operations, including cuts and fills. To seed the area, a BLM-approved seed mixture, free of noxious weeds, would be used.
- Erosion controls would be used on the disturbed areas to control erosion, runoff, and siltation of the surrounding area
- Interim reclamation would be monitored periodically to ensure that vegetation has reestablished.
- In the event that the coconut fiber mesh matting material is used, there is a possibility that a temporary fence would be utilized to protect the area until vegetation is established.

Devon would propose to grade the whole well pad to reduce the amount of non-native soil and caliche that is essential to guarantee the well pad is appropriate to accommodate the drilling rig and associated equipment, when the Minimum Elevation Change Threshold of 6 feet is met or surpassed. Full Well Pad Grade Interim Procedure (described below), is required when this approach takes place. This technique would be implemented when interim reclamation is mandatory for specific build process on this nature of well pad.

<u>Full Well Pad Grade Interim Reclamation Procedure</u>
The interim reclamation would not begin until the last well is producing for 6 months on the multi-well pad location. A variance to the standard COA will be requested within each well APD to extend the interim reclamation timeframe from 6 months to two years. Extending the timeframe will preserve the soil's protentional by reducing the amount of rework to the location. The exposed soil not covered by caliche as well as the topsoil stockpiles will be drill-seeded and covered with coconut fiber mesh matting material which is engineered to provide soil erosion protection and is UV stabilized with a two-year minimum service life. This material would remain in place and be preserved by the operator until the Standard Well Pad Interim Reclamation Procedure is executed. In the event that the coconut fiber mesh matting material is used, there is a possibility that a temporary fence would be utilized to protect the area until vegetation is established. Finally, any topsoil removed from the CTB(s) should be seeded in place.

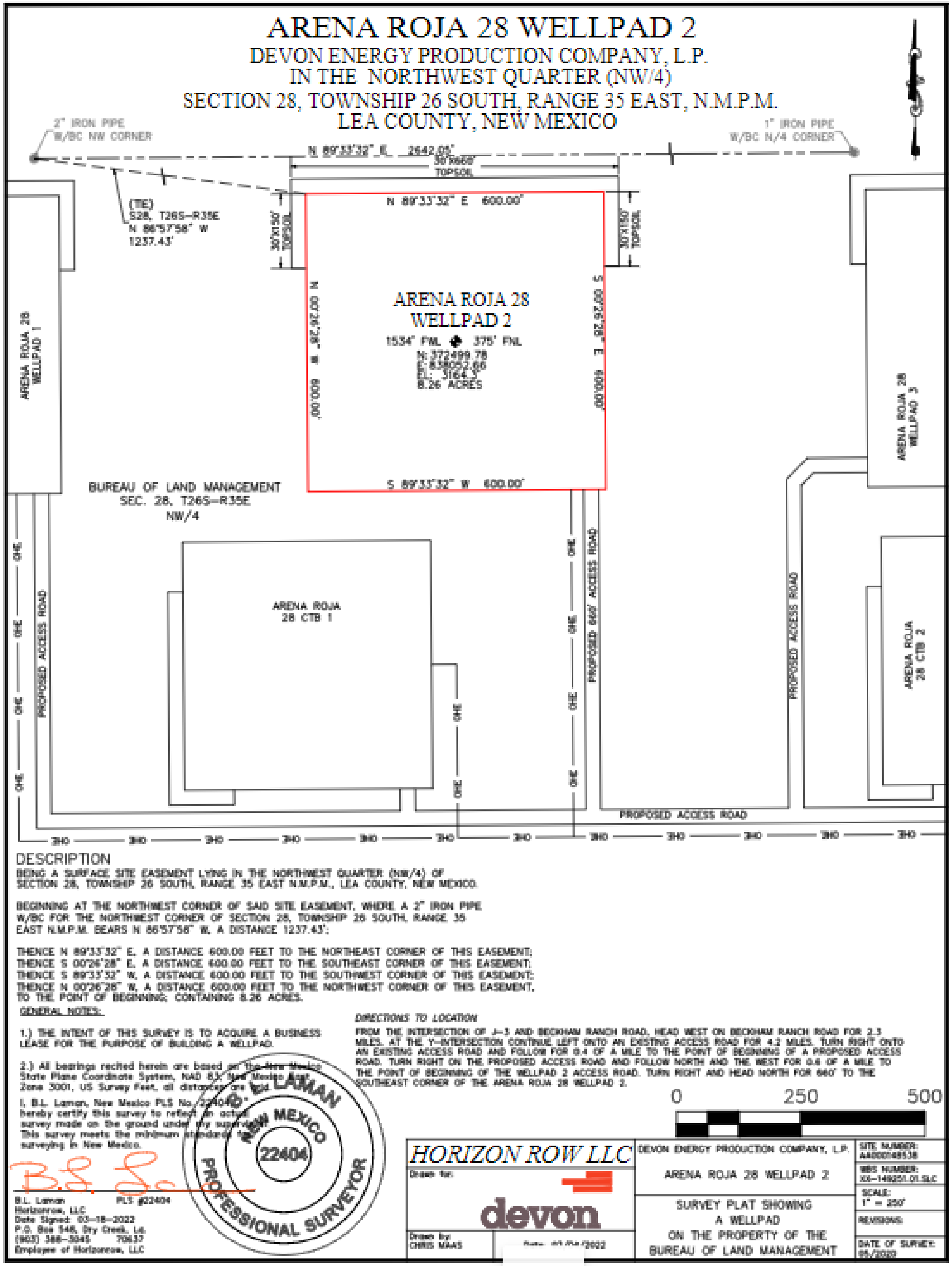


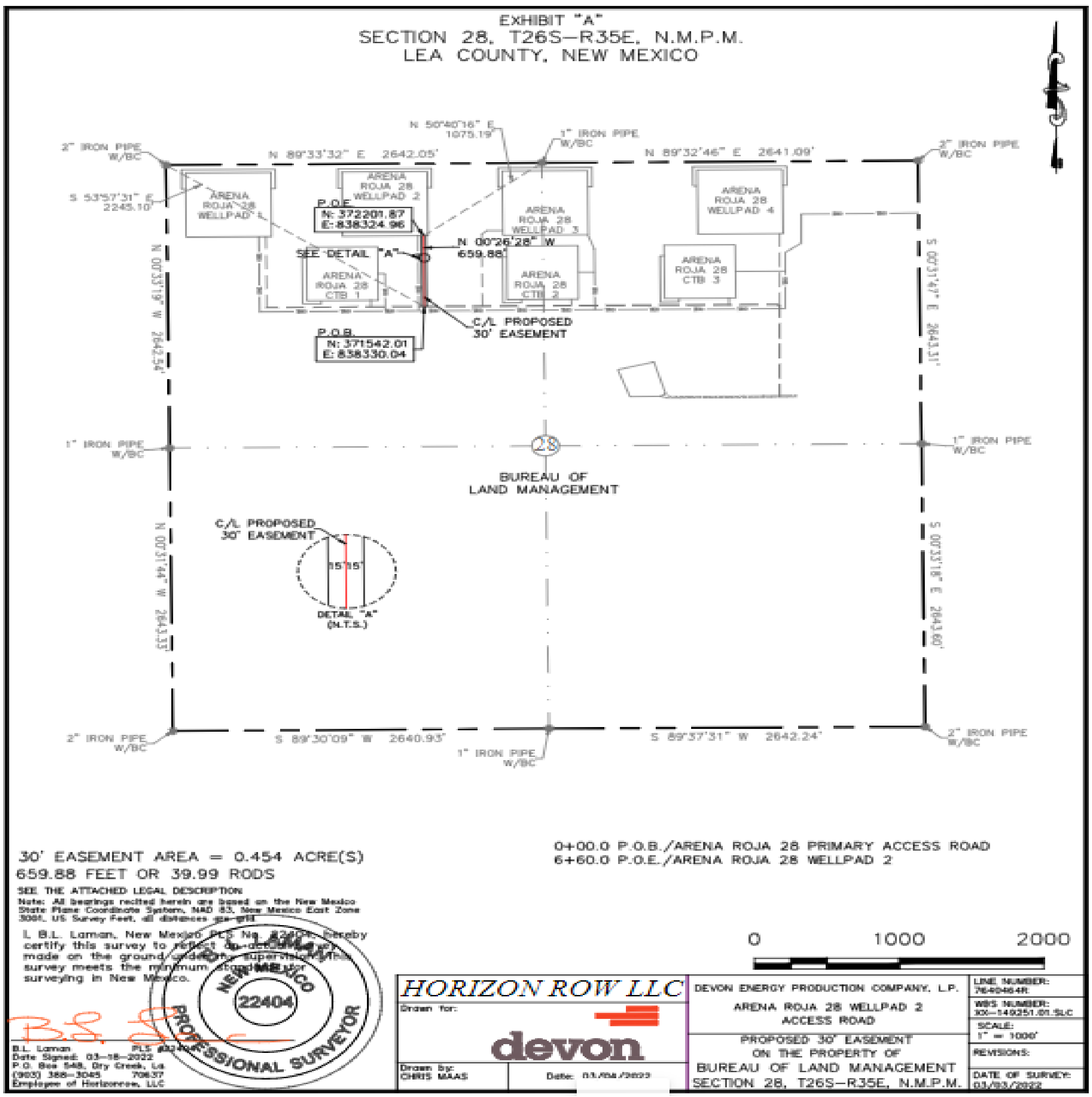
Figure 1: Project Overview Map

Proposed Access Roads:

Arena Roja 28 Well Pad 2 Access Road:
The Arena Roja 28 Well Pad 2 access road will originate from the Arena Roja 28 proposed primary access road in Section 28 of T26S/R35E. The road will travel north for 659.88 ft. until it enters and ends at the southeast corner of WP 2.

Total Length	659.88 ft.	*Acres of Disturbance*	0.454

All new roads would be constructed 14 feet in width, crowned and ditched. A maintainer will spread and compact the caliche that will be used as the surface mineral material. Caliche would be obtained from the well site or from a BLM approved pit. Turnouts would be built 1,000 feet as needed. Construction would not exceed 30 feet in disturbance width. Until final abandonment and reclamation of these locations the roads would be maintained.



Proposed Overhead Electric Lines:
Devon proposes one (1) new electric distribution lines to provide power for the life of the project.

All powerlines would be overhead and would be constructed to Avian Power Line Interaction Committee (APLIC) standards. When the electric lines would follow existing roads, the electric lines would be routed 20 feet from and parallel to the existing roads.

The sequence of electric line construction activities are as follows:

- Clear large brush or mesquite;
- Poles would be delivered to the work site on flatbed trailers pulled by trucks;
- Dig holes by using truck mounted hydraulic augers to set the poles;
- A picker truck would be used to stand the poles up and place the poles in the hole;
- The poles would be embedded into the ground, backfilled and tampered;
- Conductors (wires) would be stretched from pole to pole and attached to insulators on the pole;
- Redistribute topsoil if necessary and seed utilizing proper BLM seed mixture.

The electric lines would be a three phase 22.8/13.2 kV.

Arena Roja 28 Well Pad 2 Electric Line
The Arena Roja 28 Well Pad 2 electric line will originate from proposed Arena Roja 28 primary electric line in Section 28 of T26S/R35E. The line will travel north for 699.88 ft. until it enters and ends at the southeast edge of WP 2.
Total Length 699.88 ft. *Acres of Disturbance* 0.482

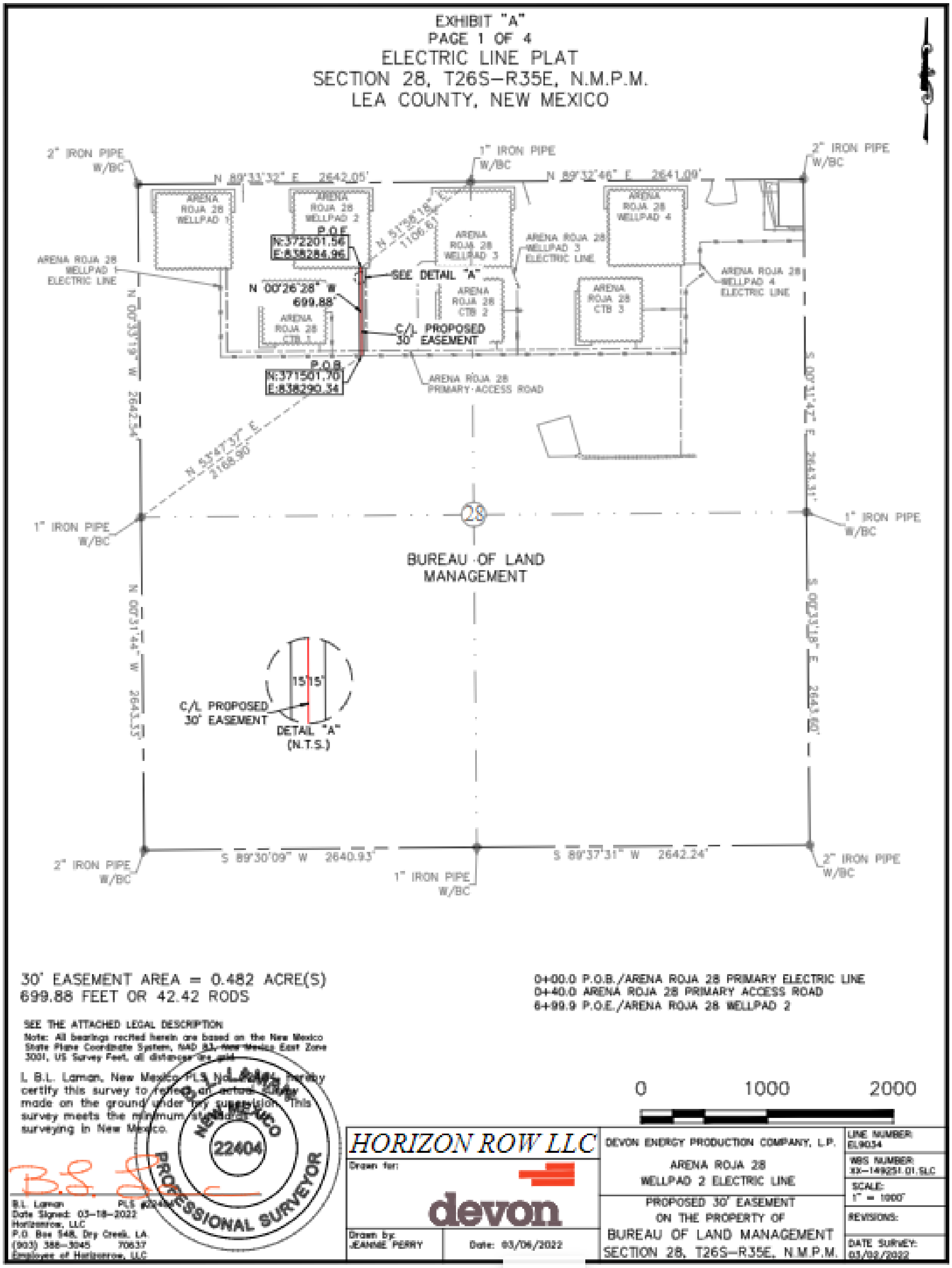


EXHIBIT "A"
PAGE 1 OF 4
ELECTRIC LINE PLAT
SECTION 28, T26S-R35E, N.M.P.M.
LEA COUNTY, NEW MEXICO
2" IRON PIPE W/BC
N 89°33'32" E 2642.05'
1" IRON PIPE W/BC
N 89°32'46" E 2641.09'
2" IRON PIPE W/BC
ARENA ROJA 28 WELLPAD 1
ARENA ROJA 28 WELLPAD 2
P.O.E.
N:372201.56
E:838284.96
N 51°58'16" E 1106.61'
ARENA ROJA 28 WELLPAD 3
ARENA ROJA 28 WELLPAD 3 ELECTRIC LINE
ARENA ROJA 28 WELLPAD 4
ARENA ROJA 28 WELLPAD 1 ELECTRIC LINE
SEE DETAIL "A"
ARENA ROJA 28 WELLPAD 4 ELECTRIC LINE
N 00°26'28" W 699.88'
ARENA ROJA 28 CTB 2
ARENA ROJA 28 CTB 3
ARENA ROJA 28 CTB 1
C/L PROPOSED 30' EASEMENT
P.O.B.
N:371501.70
E:838290.34
ARENA ROJA 28 PRIMARY ACCESS ROAD
N 00°33'19" W 2642.54'
S 00°31'42" E 2643.31'
N 53°47'37" E 2168.90'
28
1" IRON PIPE W/BC
1" IRON PIPE W/BC
BUREAU OF LAND MANAGEMENT
N 00°31'44" W 2643.33'
S 00°33'18" E 2643.60'
15' 15'
C/L PROPOSED 30' EASEMENT
DETAIL "A" (N.T.S.)
2" IRON PIPE W/BC
S 89°30'09" W 2640.93'
1" IRON PIPE W/BC
S 89°37'31" W 2642.24'
2" IRON PIPE W/BC
30' EASEMENT AREA = 0.482 ACRE(S)
699.88 FEET OR 42.42 RODS
0+00.0 P.O.B./ARENA ROJA 28 PRIMARY ELECTRIC LINE
0+40.0 ARENA ROJA 28 PRIMARY ACCESS ROAD
6+99.9 P.O.E./ARENA ROJA 28 WELLPAD 2
SEE THE ATTACHED LEGAL DESCRIPTION
Note: All bearings recited herein are based on the New Mexico State Plane Coordinate System, NAD 83, New Mexico East Zone 3001, US Survey Feet, all distances are grid.
I, B.L. Laman, New Mexico PLS No. 22404, hereby certify this survey to reflect an actual survey made on the ground under my supervision. This survey meets the minimum standards for surveying in New Mexico.
B.L. LAMAN
NEW MEXICO
22404
PROFESSIONAL SURVEYOR
B.L. Laman PLS #22404
Date Signed: 03-18-2022
Horizonrow, LLC
P.O. Box 548, Dry Creek, LA
(903) 388-3045 70637
Employee of Horizonrow, LLC
0 1000 2000
HORIZON ROW LLC
Drawn for:
devon
Drawn by: JEANNIE PERRY
Date: 03/06/2022
DEVON ENERGY PRODUCTION COMPANY, L.P.
ARENA ROJA 28
WELLPAD 2 ELECTRIC LINE
PROPOSED 30' EASEMENT
ON THE PROPERTY OF
BUREAU OF LAND MANAGEMENT
SECTION 28, T26S-R35E, N.M.P.M.
LINE NUMBER: EL9034
WBS NUMBER: XX-149251.01.SLC
SCALE: 1" = 1000'
REVISIONS:
DATE SURVEY: 03/02/2022

Proposed BURIED Flowlines:

Devon proposes one (1)- 8" composite flowlines and one (1)- 8" composite gas-lift line from the well pad to the appropriate CTB. The flowlines will be buried in the same 30 ft. wide easement. The request also includes a 20 ft. wide temporary workspace.

<u>Arena Roja 28 Well Pad 2 to Arena Roja 28 CTB 2 Flowline</u>

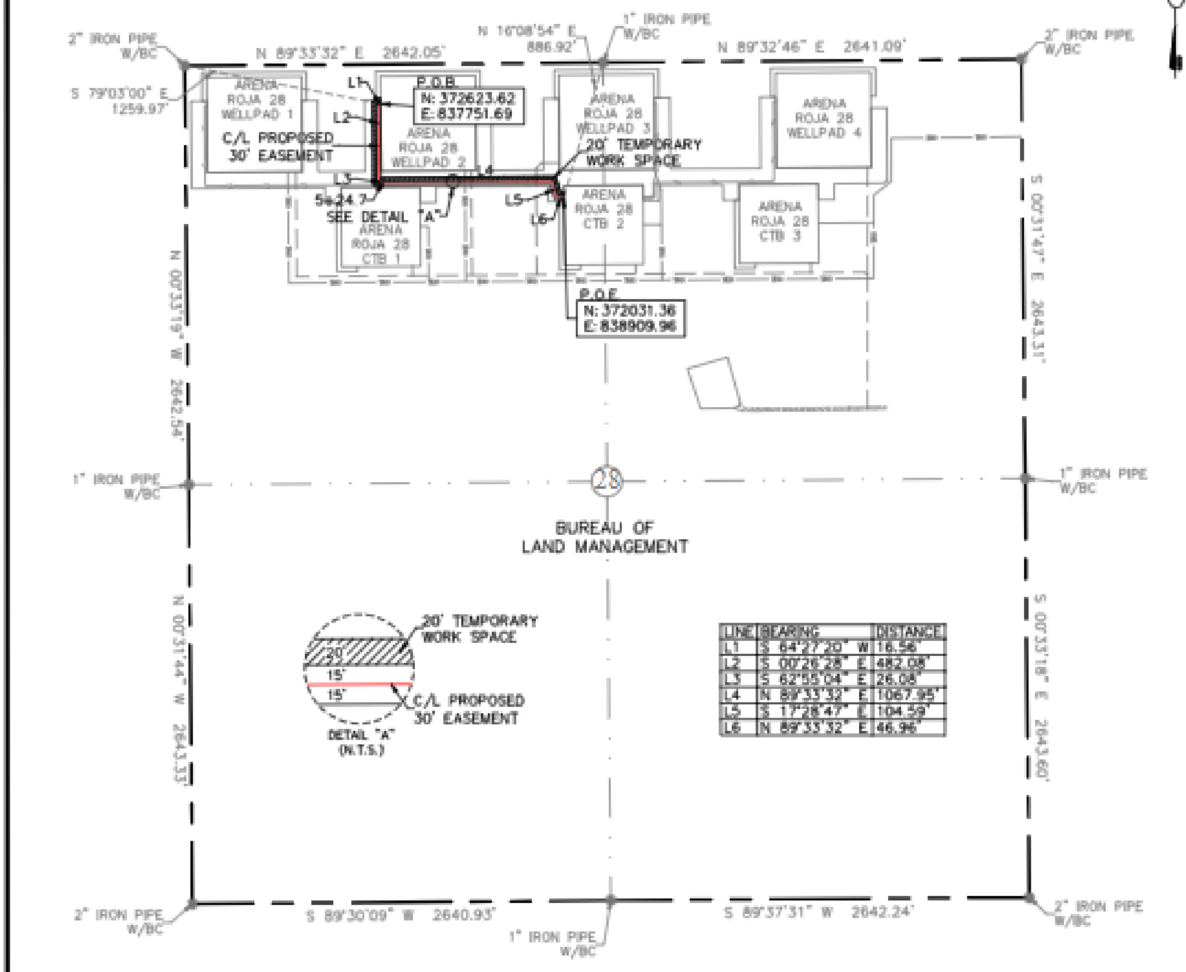
The flowlines for Arena Roja 28 Well Pad 2 to Arena Roja 28 CTB 2 will begin in Section 28 of T26S/R35E. The flowlines will originate at WP 2 and travel west for 16.56 ft. The lines will then travel south for 482.08 ft. The lines will then travel southeast for 26.08 ft. The lines will then turn east for 1,067.95 ft. The lines will then turn southeast for 104.59 ft. Finally, the lines will turn east for 46.96 ft. until they enter and end at the northwest corner of CTB 2.

Total Length	1,744.22 ft.	*Acres of Disturbance*	1.2 (Permanent)
			0.84 (Temporary)

The sequence of pipeline construction activities are as follows:

- Survey and stake edge of ROW and centerline;
- Clear/grade vegetation;
- Stockpile topsoil along the edge of ROW;
- Stringing pipe along ROW on skids so pipe can be welded together;
- Pipe is then welded together; or the poly pipe is placed in the ditch;
- X-ray tests on are done to ensure welds meet or exceed quality requirements;
- Coat pipe to prevent corrosion
- Excavate trench and lower the pipelines into trench;
- Backfill trench with a minimum of 36 inches of cover;
- Hydro-test pipelines to a pressure of 1,875 pounds per square inch gauge (PSIG);
- Compact backfill and crown trench with 6 inches of soil to account for subsidence;
- Install ancillary facilities (i.e., pig launchers, side taps, meter stations) as needed;
- Redistribute topsoil and seed utilizing proper BLM seed mixture.

EXHIBIT "A"
PAGE 1 OF 4
SECTION 28, T26S-R35E, N.M.P.M.
LEA COUNTY, NEW MEXICO



LINE	BEARING	DISTANCE
L1	S 64°27'20" W	16.56'
L2	S 00°26'28" E	482.08'
L3	S 62°55'04" E	26.08'
L4	N 89°33'32" E	1067.95'
L5	S 17°28'47" E	104.59'
L6	N 89°33'32" E	46.96'

0+00.0 P.O.B./ARENA ROJA 28 WELLPAD 2
10+46.6 STAKED ARENA ROJA 28 WELLPAD 2 ELECTRIC LINE
10+86.6 STAKED ARENA ROJA 28 WELLPAD 2 ACCESS ROAD
14+95.2 STAKED ARENA ROJA 28 WELLPAD 3 ACCESS ROAD
17+44.2 P.O.E./ARENA ROJA 28 CTB 2

30' EASEMENT AREA = 1.20 ACRE(S)
20' TEMPORARY WORK SPACE AREA = 0.840 ACRE(S)
1744.22 FEET OR 105.71 RODS

SEE THE ATTACHED LEGAL DESCRIPTION
Note: All bearings recited herein are based on the New Mexico State Plane Coordinate System, NAD 83, New Mexico East Zone 3001, US Survey Feet, all distances are grid

I, B.L. Laman, New Mexico PLS No. 22404, hereby certify this survey to reflect an actual survey made on the ground under my supervision; this survey meets the minimum standards for surveying in New Mexico.

B.L. LAMAN NEW MEXICO 22404 PROFESSIONAL SURVEYOR

B.L. Laman PLS #22404
Date Signed: 04-06-2022
P.O. Box 548, Dry Creek, La
(903) 388-3045 70637
Employee of Horizonrow, LLC

0 1000 2000

HORIZON ROW LLC
Drawn for:
devon
Drawn by: CHRIS MAAS
Date: 04/01/2022

DEVON ENERGY PRODUCTION COMPANY, L.P.
ARENA ROJA 28 WELLPAD 2 TO CTB 2 FLOWLINE
PROPOSED 30' EASEMENT ON THE PROPERTY OF BUREAU OF LAND MANAGEMENT
SECTION 28, T26S-R35E, N.M.P.M.

LINE NUMBER: AB000002684
WBS NUMBER: XX-149251.01.SLC
SCALE: 1" = 1000'
REVISIONS:
DATE OF SURVEY: 03/30/2022

Arena Roja 28 Project Summary

Proposed Action ***BLM Disturbance***	Length (ft.)	Width (ft.) Perm	Acres Perm	Width Temp	Acres Temp
Arena Roja 28 Well Pad 2	600 ft.	600 ft.	8.26	N/A	N/A
Access Roads	659.88 ft.	30 ft.	0.45	N/A	N/A
Electric Lines	699.88 ft.	30 ft.	0.45	N/A	N/A
Flowlines	1,744.22 ft.	30 ft.	1.20	20 ft.	0.84
Proposed Action Total Surface Disturbance					**11.2**

Mitigation Measures: The mitigation measures included:

- Standard stipulations for buried pipelines.
- Standard stipulations for livestock watering.
- Standard stipulations for fence lines.
- Standard Stipulations for watershed.
- Standard Stipulations for range improvements.
- Standard stipulations for soil resources.
- Standard stipulations for vegetation.
- Standard stipulations for visual resource management.
- Standard stipulations for wildlife.
- Special requirements for construction in Lesser Prairie-Chicken habitat
- Standard stipulations for noxious weeds and invasive plants.

2.2. No Action

Under this alternative, The BLM NEPA Handbook (H-1790-1) states that for Environmental Assessments (EAs) on externally initiated proposed actions, the No Action Alternative generally means that the proposed activity will not take place. This option is provided in 43 CFR 3162.3-1 (h) (2). This alternative would deny the approval of the proposed application, and the current land and resource uses would continue to occur in the proposed project area. No mitigation measures would be required.

2.3. Alternatives Considered but Eliminated from Detailed Study

There are no alternate routes that will have significantly fewer impacts or any clear advantages over the proposed action. Overall impacts to the natural resources, if an alternate route were required, would be substantially identical to the proposed action with only minor differences in disturbances to soil, vegetation, and wildlife occurring.

Field investigation of all areas of proposed surface disturbance for the Proposed Action were inspected to ensure that potential impacts to natural and cultural resources would be minimized through the implementation of mitigation measures. These measures are described for all resources potentially impacted in Chapter 3 of this EA. Therefore, no additional alternative other than those listed above have been considered for this project.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Projects requiring approval from the BLM such as right of way grants can be denied when the BLM determines that adverse effects to resources (direct or indirect) cannot be mitigated to reach a Finding of

No Significant Impact (FONSI). Under the No Action Alternative, the proposed project would not be implemented and there would be no new impacts to natural or cultural resources from the proposed project. The No Action Alternative would result in the continuation of the current land and resource uses in the project area and is used as the baseline for comparison of environmental effects of the analyzed alternatives.

During the analysis process, the interdisciplinary team considered several resources and supplemental authorities. The interdisciplinary team determined that the resources discussed below would be affected by the proposed action.

3.1. Environmental Justice

3.1.1 Affected Environment

The area of analysis for this environmental justice assessment is defined as the BLM Carlsbad Field Office (CFO) jurisdiction, in southeastern New Mexico. The CFO jurisdiction includes a portion of southwestern Chaves County, and Lea and Eddy Counties, New Mexico.

3.1.2 Impacts from the Proposed Action

Executive Order (EO) 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires federal agencies to determine if proposed actions have disproportionate and adverse environmental impacts on minority, low-income, and American Indian populations of concern. BLM policy, as contained in BLM Land Use Planning Handbook H-1601-1 (BLM 2005), Appendix D, provides direction on how to fulfill agency responsibilities for EO 12898. Environmental justice (EJ) refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies (CEQ 1997).

Following guidance from the Council on Environmental Quality (CEQ) for environmental justice concerns (CEQ 1997), the most recent available demographic data were examined to determine if environmental justice populations of concern are present in the area of analysis.

In 2010, minorities made up 60 percent of the population in the state of New Mexico compared to 36 percent in the United States as a whole. While the population of minorities in Lea and Eddy Counties (57% and 48%, respectively) substantially exceeded the United States average, it was below the state average. Based on the definition of a minority population (minority residents exceed 50% of all residents), Artesia (55%) and Loving (80%) in Eddy County and Hobbs (62%), Lovington (68%), and Jal (50%) in Lea County are all considered “environmental justice populations” for Environmental Justice compliance purposes (Census Bureau 2010). Within the area of analysis, Hispanics make up 49 percent of the total population and about 91 percent of the minority population.

Artesia and Loving are also considered environmental justice populations as determined by low-income status. All identified environmental justice populations should be considered for during implementation to avoid possible disproportionate and adverse impacts. The determination of potential adverse and disproportionate impacts from specific actions is the assessment of the BLM. This assessment should not be assumed to be the position of specific, potentially impacted, EJ populations. The BLM realizes that additional impacts may be identified by local EJ populations as specific development locations and types are proposed. As a result, this discussion assesses only the impacts for the issues identified by the BLM during internal scoping. The BLM would continue to work with affected EJ populations to identify and address additional EJ issues as they arise.

The federal government cannot dictate where oil and gas reserves may occur. Consequently, there may be instances where oil and gas exploration activities disproportionately and adversely impact environmental justice populations, due to proximity, for a limited time. The BLM CFO will utilize stipulations and best management practices (BMPs) to minimize impacts to minority and low-income populations during drilling operations, to the extent practicable.

Mitigation Measures

There are no Environmental Justice mitigation measures for this project, as currently proposed.

3.2. Air Resources

3.1.3 Affected Environment

The analysis area for this issue is the entirety of Lea, Eddy, and Chaves counties. This analysis area was selected because data on air quality emissions are collected at a county level, and the proposed action falls within these three counties. Much of the information in this section is incorporated from the Air Resources Technical Report for BLM Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas (herein referred to as AR Technical Report) (BLM 2018).

Methodology and assumptions for calculating air pollutants are described in the AR Technical Report. This document incorporates the sections discussing the modification of calculators developed by the BLM to address emissions for one horizontal gas well. The calculators give an approximation of criteria pollutant, hazardous air pollutants (HAPs), and GHGs emissions to be compared with regional and national emissions levels. Also incorporated into this document are the sections describing the assumptions used in developing the inputs for the calculator (BLM 2018a). One horizontal gas well was chosen to represent the most maximum estimated level of air quality criteria pollutants that would be emitted by a typical well in the New Mexico Permian Basin. Emissions for an oil well has been included in the Appendix X for comparison, in which emissions would be lower.

3.1.1.1 Air Quality

The U.S. Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality, including six nationally regulated ambient air pollutants of carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O3), particulate matter equal to or less than 10 microns in diameter (PM_{10}), particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). The EPA has established NAAQS for criteria pollutants that are protective of human health and the environment. The EPA has approved New Mexico's State Implementation Plan and the State enforces State and Federal air quality regulations on all public and private lands.

"Design Values" are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The most recent design values for criteria pollutants within Eddy and Lea Counties are listed below in Table 3-1 (EPA 2018). These counties do not have monitoring data for CO, Pb, and particulate matter concentrations, but because the counties are relatively rural, it is likely that these pollutants are not elevated. Between 2014 and 2017, average estimated concentrations of PM_{10} in Lea County were not listed and it is assumed that monitoring has been discontinued with approval from EPA because the affecting sources have been shut down.

Table 3-1 2017 Design Values in Eddy and Lea Counties (EPA 2018)

Pollutant	2017 Design values	Averaging Time	NAAQS	NMAAQS[e]
O_3	0.068 parts per million (ppm) (Eddy County) 0.067 ppm (Lea County)	8-hour	0.070 ppm[a]	
NO_2	3 parts per billion (ppb) (Eddy County) 4 ppb (Lea County)	Annual	53 ppb[b]	50 ppb
NO_2	24 ppb (Eddy County), 32 ppb (Lea County)	1-hour	100 ppb[c]	

Pollutant	2017 Design values	Averaging Time	NAAQS	NMAAQS[e]
$PM_{2.5}$[d]	9 micrograms per cubic meter ($\mu g/m^3$) (Lea County)	Annual	12 $\mu g/m^3$[d]	
$PM_{2.5}$[d]	17 $\mu g/m^3$ (Lea County)	24-hour	35 $\mu g/m^3$[c]	

a. Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
b. Not to be exceeded during the year
c. 98th percentile, averaged over 3 years
d. Annual mean, averaged over 3 years
e. The New Mexico Ambient Air Quality Standards (NMAAQS) standard for Total Suspended Particulates (TSP), which was used as a comparison for PM_{10} and $PM_{2.5}$, was repealed as of November 30, 2018.
h. While there are no NAAQS for hydrogen sulfide (H_2S), New Mexico has set 1/2-hour standards for H_2S at 0.100 ppm within Pecos-Permian AQ Control Region and 0.030 pp, for municipal boundaries and within five miles of municipalities with populations greater than 20,000 in areas of the state outside of the area within 5 miles of the (BLM 2018).

While all of the analysis area is in attainment of all NAAQs, including ozone, the site at 2811 Holland Street in Eddy County is the most closely watched due to the current design value of 0.068 ppm. The Carlsbad Caverns National Park is listed as having a monitor; however, the design value was not considered valid. While 0.68 is considered below the attainment value of 0.070 ppm, it is the highest design value of the monitoring stations in Eddy and Lea Counties. The potential amounts of ozone precursor emissions of nitrogen oxide(s) (NOx) and VOCs from the proposed action are not expected to impact the current design value for ozone in Chaves, Eddy, and Lea Counties; however, more information at the development stage will provide more information to better estimate air emissions from a specific project.

The Ozone Attainment Initiative is a project authorized by State Statute, 74-2-5.3 New Mexico Statutes Annotated 1978. This statute directs the New Mexico Environment Department to develop plans that may include regulations more stringent than Federal rules for areas of the state in which ambient monitoring shows ozone levels at or above 95% of the NAAQS. Currently, both Lea and Eddy Counties are within 95% of the 2015 ozone standard of 70 ppb.

Air quality in a given region can also be measured by its Air Quality Index (AQI) value. The AQI is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into six categories: good (AQI <50), moderate (50–100), unhealthy for sensitive groups (100–150), unhealthy (>150), very unhealthy, and hazardous. The AQI is a national index; therefore, the air quality rating and the associated level of health concern is the same throughout the country. The AQI is an important indicator for populations sensitive to air quality changes (EPA 2018b).

AQI values for Chaves County were mainly in the good range (AQI <50) in 2017, with 94% of the days that had an AQI in that range. The median AQI in 2017 was 14, which indicates “good” air quality. The maximum AQI in 2015 was 112, which is “unhealthy for sensitive groups,” and the 90th percentile was 31.5, which is “good” air quality (EPA 2018b).

AQI values for Eddy County were generally in the good range (AQI <50) in 2017, with 67% of the days in that range and 30% of the days in the “moderate” air quality range. The median AQI in 2017 was 45, which indicates “good” air quality. The maximum AQI in 2015 was 140, which is “unhealthy for sensitive groups,” and the 90th percentile was 80, which is “moderate” air quality (EPA 2018b).

AQI values for Lea County were generally in the good range (AQI <50) in 2017, with 67 percent of the days in that range and 32% of the days in the “moderate” air quality range. The median AQI in 2017 was 45, which indicates “good” air quality. The maximum AQI in 2015 was 133, which is “unhealthy for sensitive groups," and the 90th percentile was 68, which is "moderate" air quality (EPA 2018b). Table 3-2 lists the days where the AQI was "unhealthy for sensitive groups" or worse for the past 10 years. While there are some exceedances, the exceedances do not represent a trend of degrading AQIs.

Table 3-2 Number of Days Classified as "Unhealthy for Sensitive Groups" (AQI 101–150) or Worse (EPA 2018b)

Location	Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Chaves County	Days	0	0	0	0	0	1	0	0	0	1
Eddy County	Days	9	2	2	7	10	2	4	0	0	10
Lea County	Days	0	3	0	7	1	2	3	1	0	4

The primary sources of air pollution in the PDO are dust from blowing wind on disturbed or exposed soil, exhaust emissions from motorized equipment, oil and gas development, agriculture, and industrial sources. Table 3-5 shows total human-caused emissions for each of the counties in the PDO based on EPA's 2014 emissions inventory in tons/year (EPA 2014).

The AR Technical Report discusses the relevance of HAPs to oil and gas development and the particular HAPs that are regulated in relation to these activities (BLM 2018a). The EPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the United States. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. The EPA has identified 187 toxic air pollutants as HAPs.

The 2005 NATA identifies census tracts with estimated total cancer risk greater than 100 in a million. There are no census tracts in New Mexico with estimated total cancer risk greater than 100 in a million. Southeastern New Mexico has a total respiratory hazard index that is among the lowest in the United States.

3.1.1.2 Climate Change and GHGs

The AR Technical Report summarizes information about greenhouse gas emissions from oil and gas development and their effects on national and global climate conditions. The analysis areas associated with this proposed action are the state of New Mexico, the United States, and the globe. These geographic scales are used in this analysis to provide multiple levels of context associated with GHG emissions as a result of oil and gas development. In addition, the effects of GHG emissions are global in nature.

Climate change is a statistically significant and long-term change in climate patterns. The terms climate change and "global warming," though often used interchangeably, are not the same. Climate change is any deviation from the average climate via warming or cooling and can result from both natural and human (anthropogenic) sources. Natural contributors to climate change include fluctuations in solar radiation, volcanic eruptions, and plate tectonics. Global warming refers to the apparent warming of climate observed since the early twentieth century and is primarily attributed to human activities such as fossil fuel combustion, industrial processes, and land use changes.
The two primary GHGs associated with the oil and gas industry are carbon dioxide (CO_2) and methane (CH_4). CH_4 has a global warming potential that is 21-28 times greater than the warming potential of CO_2. The CO_2 equivalent (CO_{2e}) which takes the difference in warming potential of greenhouse gases into account is reported throughout this document. For purposes of this analysis we also use a 100-year GWP of 25, parallel with the *U.S. EPA Inventory of Greenhouse Gas and Sinks* annual reporting metrics.. More information about the range of GWPs and timeframes are reported in the *AR Technical Report* and the supplemental white paper, *Cumulative BLM New Mexico Greenhouse Gas Emissions* (BLM 2018 & BLM 2019).

The AR Technical Report and the supplemental white paper, *Cumulative BLM New Mexico Greenhouse Gas Emissions* summarizes information about greenhouse gas emissions from past, present and reasonably foreseeable GHG emissions resulting from oil and gas development on BLM lands and their effects on national and global climate conditions (BLM 2018 & BLM 2019).

3.1.4 Impacts from the Proposed Action

Direct and Indirect Impacts *(Impacts, criteria Pollutants and HAPs)*

The AR Technical Report describes the increased criteria pollutant emissions as a result of well development. The most substantial criteria pollutants emitted by oil and gas development and production are VOCs, particulate matter, and NO_2. The number of proposed wells can be found in the proposed action, section 2.1 of this document. Table 3-3 shows estimated emissions and percent increases from existing conditions resulting from reasonably foreseeable well development occurring in 2019 for the Pecos District Office (PDO) planning area. The proposed action falls under the reasonably foreseeable development for the PDO Planning area and we incorporate the data as related to well development to estimate direct impacts from the proposed action (BLM 2019, Engler 2012 & SENM 2014). To facilitate quantification, this analysis assumes that all wells would be developed concurrently and in the same year, though it is more likely that future potential development would not occur in this manner. Emission calculations for construction, operations, maintenance and reclamation are included in Appendix A for a one-well oil and gas scenario.

Construction emissions for both an oil and gas well include well pad construction (fugitive dust), heavy equipment combustive emissions, commuting vehicles and wind erosion. Emissions from operations for an oil well include well workover operations (exhaust and fugitive dust), well site visits for inspection and repair, recompletion traffic, water and oil tank traffic, venting, compression and well pumps, dehydrators and compression station fugitives. Operations emissions for a gas well include well workover operations (exhaust and fugitive dust), wellhead and compressor station fugitives, well site visits for inspection and repair, recompletions, compression, dehydrators, and compression station fugitives. Maintenance emissions for both oil and gas wells are for road travel, and reclamation emission activities are for interim and final activities and include truck traffic, a dozer, blade, and track hoe equipment.

Emissions are anticipated to be at their highest level during the construction and completion phases of implementation (approximately 30 days in duration) because these phases require the highest degree of earth-moving activity, heavy equipment use, and truck traffic, compared with the operations and maintenance phases of implementation. Emissions are anticipated to decline during operations and maintenance as the need for earth-moving and heavy equipment declines.

One of the primary sources of particulate matter (PM10 and PM2.5) emissions is from construction during well development where dust and fine particulates are generated by on-site equipment and activities, as well as off-site vehicles (Araújo et al. 2014; Reid et al. 2010). How PM interacts with the environment is dependent on a variety of factors, with the size and chemical composition of the airborne particles being the most important in terms of dispersion (distance from the source) and deposition from the atmosphere. Impacts of particulate matter emissions would not be confined to the construction site because $PM_{2.5}$ (fine particles) can travel farther in terms of distance than PM_{10} (dust) and other total suspended particulates (particles of sizes up to 50 micrometers) and therefore can impact local residents in the surrounding area (Araújo et al. 2014). VOCs and NO_2 contribute to the formation of O_3, which is the pollutant of most concern in southeastern New Mexico (see Table 3.1) and because O_3 is not a direct emission, emissions of NOx and VOCs are used as a proxy for estimating O_3 levels.

The supplemental white paper *Cumulative BLM New Mexico Greenhouse Gas Emissions* provides information related to the reasonably foreseeable development for the PDO Planning area. Reasonable foreseeable development (2016-2035) shows well development with an average of 320 federal wells per year and 6,400 cumulative federal wells. The number of average wells, 320, is multiplied by the pollutant emission factor from Appendix A for a gas well scenario to calculate reasonably foreseeable emissions related to well development in 2019 (Table 3-3). The BLM understands that the timing of well development varies. Because well development varies (i.e. permit approval, well pad construction, spudding, and completion) the phases of development may not occur in succession but may be spread out in development over time. Historically well completions since 2014 has varied from 584 completed in

2014 to 378 wells completed in 2017 (Table 3-4). Table 3-3 shows the impacts (emissions increase) associated with reasonably foreseeably well development in the PDO for 2019.

Table 3-3 Percent Increase from Reasonable Foreseeable Development (RDF) of Oil and Gas Wells

	Emissions (Tons per Year)					
	PM_{10}	**$PM_{2.5}$**	**NOx**	**SO_2**	**CO**	**VOC**
Human-caused Current Emissions (Chaves, Eddy and Lea counties)	40,085	6,021	29,482	1,886	50,227	115,793
One well emissions[a]	*5.31*	*0.81*	*6.19*	*0.11*	*2.63*	*1.17*[b]
Total Emissions for 2019 Reasonably Foreseeable Well Development (320 wells)	1699.2	259.2	1980.8	35.20	841.6	374.4
Percent Increase	4.23%	4.30%	6.72%	1.87%	1.68%	0.32%

[a] The representative well used to calculate emissions is a horizontal gas well. Emissions for vertical wells were not used from this analysis due to current predominance in horizontal technological drilling methods and because presenting horizontal gas wells emissions estimates represents a more conservative summary of emissions, compared with emissions from a vertical well, with the exception of SO_2, which could be 4 to 5 times greater in a vertical well scenario. However, sulfur dioxide emissions are still estimated to be within the same magnitude and less <1 ton per year of SO_2 emissions per well. See Appendix A for additional discussion of emission factors.
[b] VOC emissions at the operational phase represent a 95% control efficiency and estimates potential emissions representing the contribution for "one oil well" from the emissions at storage tanks, gathering facilities, etc.

While impacts to air quality on a broad-scale in the analysis area show an addition of 6.72% and approximately 4% for NOx and PM respectively, the proposed action would result in even smaller individualized impacts as development would not occur at the same time and in the same space but over a span of time. Localized and short term impacts to air quality for nearby residences from emissions of particulate matter, NOx, VOCs, and HAPs is expected. Under the Proposed Action, the additional NOx and VOCs emitted from the oil and gas wells are anticipated to be too small in quantity to result in exceedances of O_3 in the analysis area. This incremental addition would not be expected to result in an exceedance of the NAAQS or State air quality standards for any criteria pollutants in the analysis area because the addition of criteria pollutants and VOCs, as shown in Table 3-3 are scaled down to the proposed action level.

Hazardous Air Pollutants (HAPs)

The formulas used for calculating HAPs in the calculators are very imprecise. For many processes it is assumed that emission of HAPs will be equivalent to 10% of VOC emissions. Therefore the HAP emissions reported here should be considered a very gross estimate and likely an overestimate. The calculator estimates that a maximum of 37.44 tons/year of HAPs would be emitted during the construction, and first year of operation during the development of 320 wells using emission factors from a gas well in the Permian Basin. The emissions are a combination of HAP constituents existing in natural gas and released during the completion and operation process. Most gas vented during the completion process is flared, which substantially reduces the quantity of HAPs released.

Impacts Climate Change and GHGs

Climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from a proposed land management action cannot be

accurately translated into effects on climate change globally or in the area of any site-specific action. Currently, Global Climate Models are unable to forecast local or regional effects on resources (IPCC 2013). However, there are general projections regarding potential impacts to natural resources and plant and animal species that may be attributed to climate change from GHG emissions over time; however these effects are likely to be varied, including those in the southwestern United States (Karl, 2009). Climate change projections are based on a hierarchy of climate models that range from simple to complex, coupled with comprehensive Earth System Models. Additional near-term warming is inevitable due to the thermal inertia of the oceans and ongoing GHG emissions. A more detailed discussion of climate change and the relationship of GHGs to climate change as well as the intensity and effects on national and global climate is presented in the AR Technical Report and the supplemental white paper, *Cumulative BLM New Mexico Greenhouse Gas Emissions* (BLM 2018 & BLM 2019).
Analysis of the impacts of the proposed action using GHG emissions as a proxy for impacts are reported below in Table 3-4. Direct impacts of the proposed action are the result of well development activities that includes drill rig operations, workover operations (exhaust), recompletion traffic, venting, compression and well pumps, dehydrators and compression station fugitives as well as other sources that generate carbon dioxide, methane, nitrous oxide.

The *Cumulative BLM New Mexico Greenhouse Gas Emissions* provides information related to the reasonably foreseeable development for the BLM PDO Planning area. Reasonable foreseeable development (2016-2035) shows an average of 320 federal wells per year could be developed and 6,400 cumulative federal wells. Reasonably foreseeable oil and gas production is also provided where total cumulative federal production would result in 1116.73 MMT of CO2e over the life of the RFD (BLM 2019). In 2019, RFD volumes show indirect GHG emissions would be emitted from 79.39 MMbbls of oil and 304,935 MMcf of gas. This proposed action falls under the reasonably foreseeable development and end-use combustion of oil and gas for the PDO area and we incorporate the data as related to well development and production volumes to estimate direct and indirect GHG impacts from the proposed action (Engler 2012 & SENM 2014). The proposed action will yield approximately 795,000 barrels of oil equivalent (BOE) for every horizontal well completed in the Bone Spring Sand and 1,116,000 BOE for per well drilled in the Wolfcamp Shale (Mire and Moomaw 2017). The proposed action would result in end use combustion emissions of 341,850 MT of CO2e per Bone Spring Sand well and 479,880 MT of CO2e for per Wolfcamp Shale Well.

Historically well completions since 2014 has varied from 584 completed in 2014 to 378 wells completed in 2017 (Table 3-4). Table 3-4 also shows the direct GHG emissions associated with reasonably foreseeably well development in the Pecos District Office for 2019. GHG emission calculations for construction, operations, maintenance and reclamation are included in Appendix A for a one-oil and gas well scenario. The AR Technical report provides annual updates to actual well completions in the Pecos District Office in which we then associate the GHG emission factor from Appendix A to the number of well completions per year. Table 3-5 presents indirect end-use GHG emissions for the United States, New Mexico as well as the major BLM federal oil and gas basins associated with the reasonably foreseeable production of oil and gas. A discussion of the methodology and assumptions for this data is contained in the *Cumulative BLM New Mexico Greenhouse Gas Emissions* (BLM 2019). The proposed action falls under the reasonably foreseeable development for the PDO area and we incorporate the data as related to production data to calculate indirect impacts from the proposed action (Engler 2012 & SENM 2014). Historically CO2e emissions from federal oil and gas production for the PDO has varied from 40.10 MMT of CO2e/year in 2014 to 48.85 MMT of CO2e/year in 2017. The reasonably foreseeable indirect GHG emissions resulting from oil and gas well development in 2019 is estimated at 50.82 MMT CO2e/year (Table 3-4).

Table 3-4 Well Completions and estimated GHG emissions based on APD Activity

Pecos District Office	2014	2015	2016	2017	2018	BLM 2019 RFD	BLM RFD (2016-2035)

# of BLM Well Completions*	584	400	389	378	518	320	6,400
Metric Tons of CO_2e/year	731,517	501,039	487,260	473,482	648,846	400,831	8,016,624

*Emission factor (metric tons of CO_2e per well) is from Tables A 1-2 of Appendix A
# of BLM federal & non-federal wells in PDO RFD (2016-2037) is 16,000.
*PDO BLM wells Includes completions from Carlsbad, Hobbs and Roswell Field Offices
*Wells completed reported from AFMSS 1&2 with run date June 20, 2019.

Table 3-5 Historical oil and gas production and Reasonably Foreseeable Development

Oil and Gas Production	2014	2015	2016	2017	RFD
U.S. Oil Production (Mbbls)[1]	3,196,889	3,442,188	3,232,025	3,413,376	3,639,277
New Mexico Oil Production (Mbbls)	125,021	147,663	146,389	171,440	*
PDO Oil Production (Mbbls)	62,007	73,344	74,810	76,307	79,389
FFO Oil Production (Mbbls)	5,755	8,457	6,889	5,980	5,451
U.S. Gas Production (MMcf)[1]	25,889,605	27,065,460	26,592,115	27,291,222	30,743,208
New Mexico Gas Production (MMcf)	1,140,626	1,151,493	1,139,826	1,196,514	*
PDO Gas Production (MMcf)	245,550	281,713	287,347	293,094	304,935
FFO Gas Production (MMcf)	664,211	642,211	596,747	464,709	196,868
GHG Emissions					
Total U.S. O&G GHG Emissions (MMT) CO2e1	2791.29	2961.11	2844.84	2961.08	3,247
Total New Mexico O&G GHG Emissions (MMT CO_2e)	116.17	126.50	125.32	139.19	138.9
Total PDO O&G GHG Emissions (MMT CO_2e)	40.10	46.95	47.89	48.85	50.82
Total FFO O&G GHG Emissions (MMT CO_2e)	38.82	38.78	35.62	28.00	13.12

1 RFD for the U.S. data projects productions volumes based on year 2020.
*The RFD for New Mexico production is for year 2020. Production volumes to estimate total GHGs use both production and consumption volumes using data from Golder Associates 2017.The methodology can be found in this report.

Cumulative Impacts Criteria Pollutants, HAPs and GHGs

Activities that contribute to levels of air pollutant and GHG emissions in the Permian Basin include fossil fuel industries, vehicle travel, industrial construction, potash mining, and others. A complete inventory of criteria pollutant emissions can be found in a report titled “Southeast New Mexico Inventory of Air Pollutant Emissions and Cumulative Air Impact Analysis 2007” (AES 2011). The AR Technical Report includes a description of the varied sources of national and regional emissions that are incorporated here to represent the past, present and reasonably foreseeable impacts to air resources (BLM, 2018). It includes a summary of emissions on the national and regional scale by industry source. Sources that are considered to have notable contributions to air quality impacts and GHG emissions include electrical generating units, fossil fuel production (nationally and regionally), and transportation.

The AR Technical Report discusses the relationship of past, present, and future predicted emissions to climate change and the limitations in predicting local and regional impacts related to emissions. It is currently not feasible to know with certainty the net impacts from particular emissions associated with activities on public lands. However, the small incremental increase in GHGs from this project will not have a measurable impact on climate. Because GHGs affect climate change and climate change is a result various processes occurring in tandem with other global processes, in analyzing direct and indirect impacts we also analyze for cumulative impacts.

The emissions calculator estimated that there could be small direct increases in several criteria pollutants, HAPs, and GHGs as a result of the proposed action. The small increase in emissions that could result from approval of the proposed action would not result in Eddy, Lea, or Chavez County exceeding the NAAQS for any criteria pollutants. The applicable regulatory threshold for HAPs is the oil and gas industry National Emissions Standards for Hazardous Air Pollutants, which are currently under review by the EPA. The emissions from the proposed well are not expected to impact the 8-hour average ozone concentrations, or any other criteria pollutants in the Permian Basin.

Table 3-6 Relative Oil and Gas Combustion Emissions

Emissions Scope	**$CO2_e$ (Million Metric Tonnes)**
U.S. Total *	3,829.2
New Mexico **	27.7
Project ***	0.445

*Source: Inventory of U.S. Greenhouse Gas emissions and Sinks: 1990-2019, Table 3-5
**https://cnee.colostate.edu/wp-content/uploads/2021/01/New-Mexico-GHG -Inventory-and-Forecast-Report_2020-10-27_final.pdf, Table 2
***BLM Lease Sale Emissions Tool (11/21/2022)

Monetized Impacts from GHGs

The “social cost of carbon”, “social cost of nitrous oxide”, and “social cost of methane” – together, the “social cost of greenhouse gases” (SC-GHG) are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year.

On January 20, 2021, President Biden issued E.O. 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*.[1] Section 1 of E.O. 13990 establishes an Administration policy to, among other things, listen to the science; improve public health and protect our environment; ensure access to clean air and water; reduce greenhouse gas emissions; and bolster resilience to the impacts of climate change.[2] Section 2 of the E.O. calls for Federal agencies to review existing regulations and policies issued between January 20, 2017, and January 20, 2021, for consistency with the policy articulated in the E.O. and to take appropriate action.

Consistent with E.O. 13990, the Council on Environmental Quality (CEQ) rescinded its 2019 “Draft National Environmental Policy Act Guidance on Considering Greenhouse Gas Emissions” and has begun to review for update its “Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews” issued on August 5, 2016 (2016 GHG Guidance).[3] While CEQ works on updated guidance, it has instructed agencies to consider and use all tools and resources available to them in assessing GHG emissions and climate change effects including the 2016 GHG Guidance.[4]

[1] 86 FR 7037 (Jan. 25, 2021).
[2] *Id*., sec. 1.
[3] 86 FR 10252 (February 19, 2021).
[4] *Id.*

Regarding the use of Social Cost of Carbon or other monetized costs and benefits of GHGs, the 2016 GHG Guidance noted that NEPA does not require monetizing costs and benefits.[5] It also noted that "the weighing of the merits and drawbacks of the various alternatives need not be displayed using a monetary cost-benefit analysis and should not be when there are important qualitative considerations."[6]

Section 5 of E.O. 13990 emphasized how important it is for federal agencies to "capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account" and established an Interagency Working Group on the Social Cost of Greenhouse Gases (the "IWG"). [7] "). In February of 2021, the IWG published *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide: Interim Estimates under Executive Order 13990*(IWG, 2021).[8] This is an interim report that updated previous guidance from 2016.

In accordance with this direction, this subsection provides estimates of the monetary value of changes in GHG emissions that could result from selecting each alternative. Such analysis should not be construed to mean a cost determination is necessary to address potential impacts of GHGs associated with specific alternatives. These numbers were monetized; however, they do not constitute a complete cost-benefit analysis, nor do the SC-GHG numbers present a direct comparison with other impacts analyzed in this document. SC-GHG is provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making.

For Federal agencies, the best currently available estimates of the SC-GHG are the interim estimates of the social cost of carbon dioxide (SC-CO_2), methane (SC-CH_4), and nitrous oxide (SC-N_2O) developed by the Interagency Working Group (IWG) on the SC-GHG. Select estimates are published in the Technical Support Document (IWG 2021)[9] and the complete set of annual estimates are available on the Office of Management and Budget's website[10].

The IWG's SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are a less significant factor in present-day decisions). The current set of interim estimates of SC-GHG have been developed using three different annual discount rates: 2.5%, 3%, and 5% (IWG 2021).

As expected with such a complex model, there are multiple sources of uncertainty inherent in the SC-GHG estimates. Some sources of uncertainty relate to physical effects of GHG emissions, human behavior, future population growth and economic changes, and potential adaptation (IWG 2021). To better understand and communicate the quantifiable uncertainty, the IWG method generates several thousand estimates of the social cost for a specific gas, emitted in a specific year, with a specific discount rate. These estimates create a frequency distribution based on different values for key uncertain climate

[5] 2016 GHG Guidance, p. 32, available at: https://ceq.doe.gov/docs/ceq-regulations-and-guidance/nepa_final_ghg_guidance.pdf
[6] *Id*.
[7] E.O. 13990, Sec. 5.
[8] https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf
[9] IWG 2021. *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide, Interim Estimates under Executive Order 13990.* Interagency Working Group on Social Cost of Greenhouse Gasses, February 2021.
[10] https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs

model parameters. The shape and characteristics of that frequency distribution demonstrate the magnitude of uncertainty relative to the average or expected outcome.

To further address uncertainty, the IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average damages from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95th percentile of damages estimated, applying a 3% annual discount rate for future economic effects. This is a low probability, but high damage scenario, represents an upper bound of damages within the 3% discount rate model. The estimates below follow the IWG recommendations.

The SC-GHGs associated with estimated emissions from the proposed action alternative are analyzed in the first part of this subsection. These estimates represent the present value of future market and nonmarket costs associated with CO_2, CH_4, and N_2O emissions. Estimates are calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and BLM's estimates of emissions in each year. They are rounded to the nearest $1,000.

Table 3-7. SC-GHGs Associated with Future Potential Development

	Social Cost of GHG (2020$)			
	Average Value, 5% discount rate	**Average Value, 3% discount rate**	**Average Value, 2.5% discount rate**	**95th Percentile Value, 3% discount rate**
Development and Operations	$1,831,000	$6,081,000	$8,908,000	$17,683,000
End-Use	$4,663,000	$16,236,000	$24,160,000	$48,464,000
Total	**$6,494,000**	**$22,317,000**	**$33,068,000**	**$66,147,000**

Source: BLM Lease Sale Emissions Tool and BLM SC-GHG Calculator (11/21/2022).

Mitigation Measures and Residual Impacts

A discussion on mitigation measures can be found in the section of *Cumulative BLM New Mexico Greenhouse Gas Emissions, A Supplemental White Paper*.

3.3. Water Resources

The BLM Pecos District Office, which oversees the Carlsbad and Roswell Field Offices and the Hobbs Field Station, encompasses over 3.5 million acres of public lands and over 7 million acres of Federal mineral estate. The Pecos District includes the New Mexico portion of the Permian Basin, a sedimentary depositional basin. The Permian Basin is one of the premier oil and gas producing regions in the United States (U.S.), and prolific producing horizons occur in the New Mexico portion of the basin in Eddy and Lea Counties. The Permian Basin has been a producing oil and natural gas field since the early 1900s. There are approximately 15,660 active Federal wells are within the boundary of the Pecos District.

This section presents information on existing and projected water quantity and water quality data for the Pecos District as summarized from information gathered from the Reasonable Foreseeable Development (RFD) Scenario for the BLM. New Mexico Pecos District (Engler and Cather 2012) and 2014, and data compiled from a 2015 USGS report, Estimate Use of Water in the United States in 2015 (Dieter et. al. 2018), and FracFocus, a national hydraulic fracturing chemical registry managed by the Ground Water Protection Council and Interstate Oil and Gas Compact Commission (FracFocus 2018).

3.2.1 Affected Environment

Water Quantity

Existing Surface and Ground Water Use in the Pecos District

The 2015 USGS Report, Estimate Use of Water in the United States in 2015 (Dieter et al. 2018), lists total water withdrawals across eight water use categories: aquaculture, domestic, industrial, irrigation, livestock, mining, public water supply, and thermoelectric power. Tables 3.6 through Table 3.8 list the total 2015 water withdrawals in for the eight water use categories for each of the three counties within the Pecos District ("Pecos District Tri-County Area"). Table 3-9 presents combined water use for the Pecos District Tri-County Area. This area is roughly analogous to the New Mexico portion of the Permian Basin. As shown in the tables, Irrigation is the largest category of water use in all counties, accounting for an average of 75 percent (466,784 acre-feet ([AF]) of the total water withdrawal for the Pecos District Tri-County Area (619,375 AF). Approximately 88 percent (545,154 AF) of the total water use for Pecos District Tri-County Area is from groundwater. Mining (which includes oil and gas development) comprises approximately 15 percent of Pecos District Tri-County Area water withdrawals. All mining-related water use (94,758 AF) is from groundwater. Of that total, 99 percent of withdrawals are from saline sources. Most (87 percent) mining-related water use occurs in Lea County, where mining comprises 31 percent of the total county withdrawals. The relative use of water by industry within the Pecos District Tri-County Area is depicted in Figure 1. The relative use of surface water and fresh/ saline groundwater by industry within the Pecos District Tri-County Area is depicted in Figure 2.

Table 3-6 Lea County 2015 Water Use by Category (af/yr)

Category	Surface Water				Groundwater				Total Withdrawals					
	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	Percent Total Use	AF Saline	Percent Total Use	AF Total	Percent Total Use
Public Water Supply	0	0	0	0%	11,423	0	11,423	100%	11,423	100%	0	0%	11,423	4%
Industrial	0	0	0	0%	78	0	78	100%	78	100%	0	0%	78	0%
Irrigation	0	0	0	0%	166,099	0	166,099	100%	166,099	100%	0	0%	166,099	62%
Livestock	56	0	56	2%	2,870	0	2,870	98%	2,926	100%	0	0%	2,926	1%
Aquaculture	0	0	0	0%	0	0	0	0%	0	0%	0	0%	0	0%
Mining	0	0	0	0%	325	81,642	81,968	100%	325	0.4%	81,642	99.6%	81,968	31%
Thermoelectric power	0	0	0	0%	1,827	0	1,827	100%	1,827	100%	0	0%	1,827	1%
Domestic	0	0	0	0%	1,513	0	1,513	100%	1,513	100%	0	0%	1,513	1%
County Totals	**56**	**0**	**56**	**0%**	**184,136**	**81,642**	**265,778**	**100%**	**184,192**	**69%**	**81,642**	**31%**	**265,834**	**100%**

Source: Dieter et al. 2017.

Table 3-7 Eddy County 2015 Water Use by Category (af/yr)

Category	Surface Water				Groundwater				Total Withdrawals					
	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	Percent Total Use	AF Saline	Percent Total Use	AF Total	Percent Total Use
Public Water Supply	0	0	0	0%	15,077	0	15,077	100%	15,077	100%	0	0	15,077	8%
Industrial	0	0	0	0%	1,043	0	1,043	100%	1,043	100%	0	0%	1,043	1%
Irrigation	64,054	0	64,054	42%	89,994	0	89,994	58%	154,048	100%	0	0%	154,048	84%
Livestock	34	0	34	3%	1,289	0	1,289	97%	1,323	100%	0	0%	1,323	1%
Aquaculture	0	0	0	0%	0	0	0	0%	0	0%	0	0%	0	0%
Mining	0	0	0	0%	1,169	10,993	12,162	100%	1,169	10%	10,993	90%	12,162	6%
Thermoelectric power	0	0	0	0%	0	0	0	0%	0	0%	0	0%	0	0%
Domestic	0	0	0	0%	258	0	258	100%	258	100%	0	0%	258	0%
County Totals	**64,088**	**0**	**64,088**	**35%**	**108,30**	**10,993**	**119,823**	**65%**	**172,918**	**94%**	**10,993**	**6%**	**183,910**	**100%**

Source: Dieter et al. 2017.

Table 3-8 Chavez County 2015 Water Use by Category (af/yr)

Category	Surface Water				Groundwater				Total Withdrawals					
	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	Percent Total Use	AF Saline	Percent Total Use	AF Total	Percent Total Use
Public Water Supply	0	0	0	0%	12970	0	12,970	100%	12,970	100%	0	0	12,970	8%
Industrial	0	0	0	0%	0	0	0	0%	0	0%	0	0%	0	0%
Irrigation	9,854	0	9,854	7%	136,784	0	136,784	93%	146,638	100%	0	0%	146,638	86%
Livestock	224	0	224	3%	6,378	0	6,378	97%	6,603	100%	0	0%	6,603	4%
Aquaculture	0	0	0	0%	1,782	0	1,782	100%	1,782	100%	0	0%	1,782	1%
Mining	0	0	0	0%	78	1,592	1,670	100%	78	5%	1,592	95%	1,670	1%
Thermoelectric power	0	0	0	0%	0	0	0	0%	0	0%	0	0%	0	0%
Domestic	0	0	0	0%	1,009	0	1,009	100%	1,009	100%	0	0%	1,009	1%
County Totals	**10,078**	**0**	**10,078**	**6%**	**159,003**	**1,592**	**160,594**	**94%**	**169,080**	**99%**	**1,592**	**1%**	**170,672**	**100%**

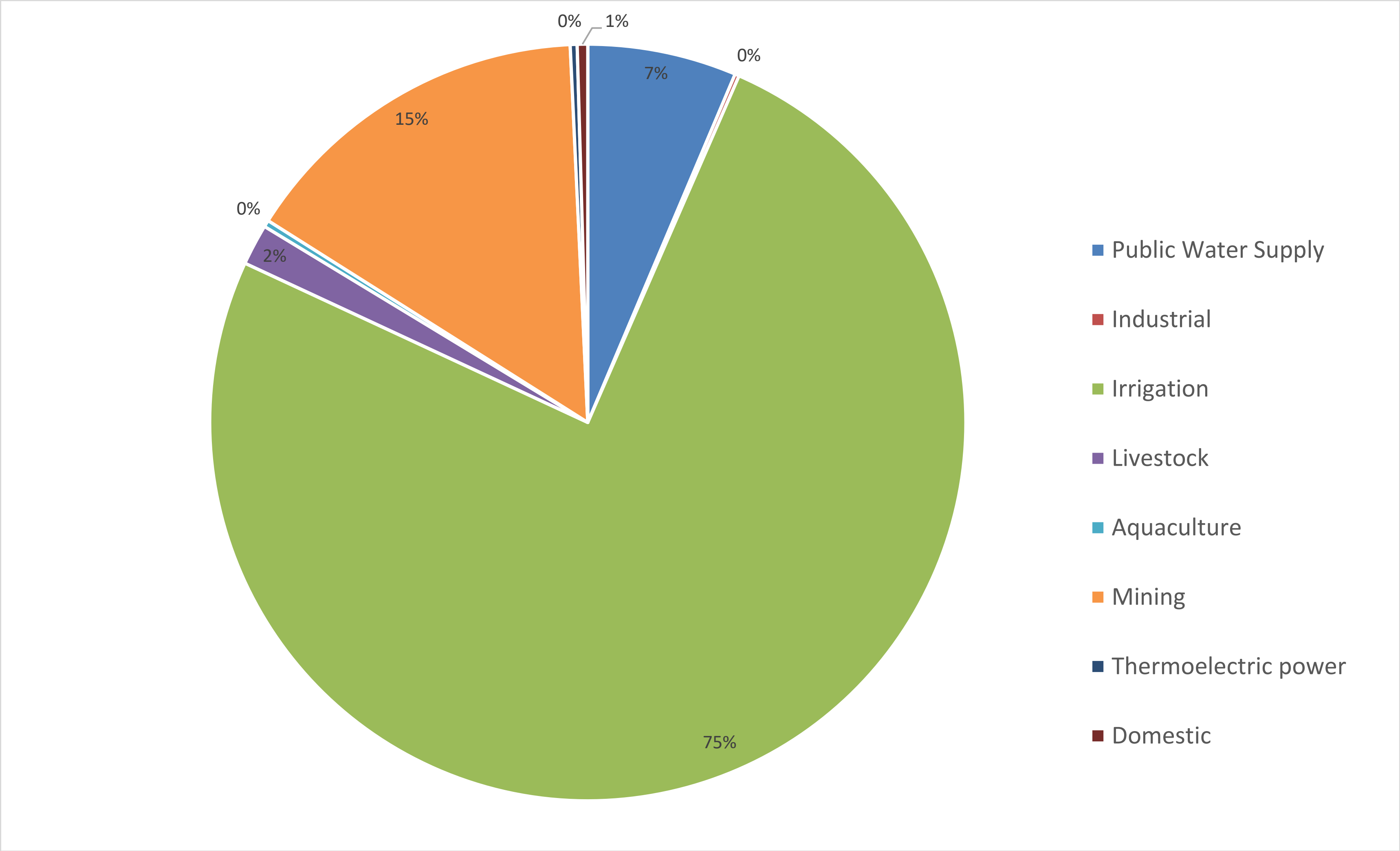
Source: Dieter et al. 2017.

Table 3-9 Pecos District Tri-County Area 2015 Water Use by Category (af/yr)

Category	Surface Water				Groundwater				Total Withdrawals					
	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	Percent Total Use	AF Saline	Percent Total Use	AF Total	Percent Total Use
Public Water Supply	-	-	-	0%	39,470	-	39,470	100%	39,470	100%	0	0	39,470	6%
Industrial	-	-	-	0%	1,121	-	1,121	100%	1,121	100%	0	0%	1,121	0%
Irrigation	73,908	-	73,908	16%	392,877	-	392,877	84%	466,784	100%	0	0%	466,784	75%
Livestock	314	-	314	3%	10,537	-	10,537	97%	10,851	100%	0	0%	10,851	2%
Aquaculture	-	-	-	0%	1,782	-	1,782	100%	1,782	100%	0	0%	1,782	0%
Mining	-	-	-	0%	1,573	94,227	95,800	100%	1,573	1%	24,227	99%	95,800	15%
Thermoelectric power	-	-	-	0%	1,827	-	1,827	100%	1,827	100%	0	0%	1,827	0%
Domestic	-	-	-	0%	2,780	-	2,780	100%	2,780	100%	0	0%	2,780	0%
District Totals	**74,221**	**-**	**74,221**	**12%**	**451,968**	**24,227**	**546,195**	**88%**	**526,195**	**85%**	**24,227**	**15%**	**620,416**	**100%**

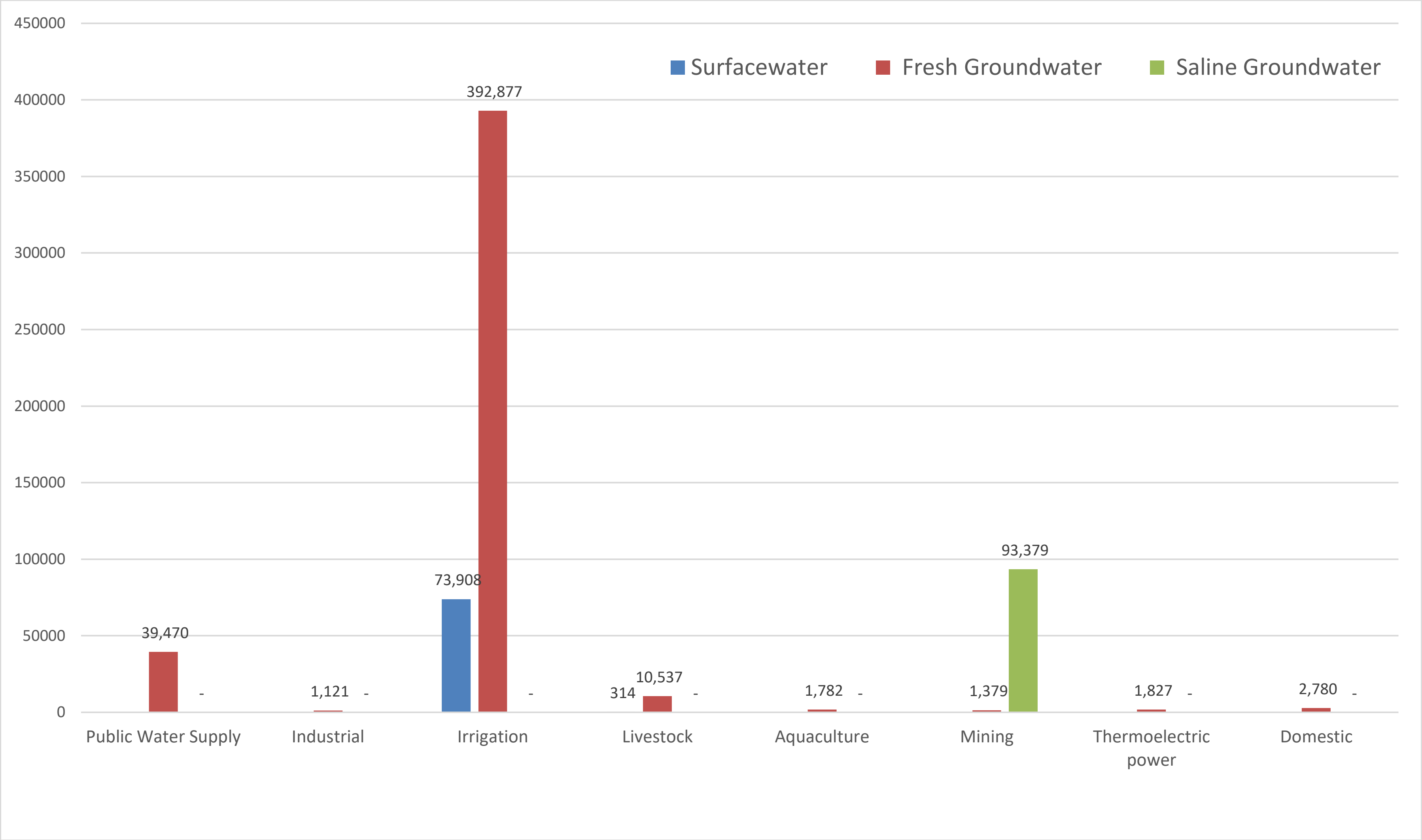
Source: Dieter et al. 2017.

Figure 1 Pecos District Tri-County Area 2015 water use by category



Source: Dieter et al. 2017.

Figure 2 Pecos District Tri-County Area 2015 water use by water type and category



Source: Dieter et al. 2017.

State of New Mexico Water Use

In 2015, withdrawals for all water use categories across the State of New Mexico totaled 3,249,667 AF (USGS 2015). Pecos District Tri-County Area total water usage (619,375 AF) accounted for about 19 percent of the total state withdrawals. Table 3-10 lists the water for the major categories in New Mexico. As shown in the table, Mining water withdrawals totaled 163,901 AF, or about 5 percent of the total water withdrawals for the State of New Mexico. While the data presented in this table are for the state as a whole; most water use in this category is from the Permian Basin with some water use from the San Juan Basin. Table 3-11 presents water use associated with oil and gas development in New Mexico, by county. As shown in the table, over 99 percent of the water use associated with oil and gas development occurs in the Pecos District Tri-County Area (3,994 AF). Water use associated with oil and gas development comprises approximately 2.5 percent of the statewide Mining water use (163,901 AF, see Table 3-10) and 4.2% of the Pecos District Tri-County Area Mining water use (94,758 AF, see Table 3-9).

Table 3-10 State of New Mexico Use by Category (AF/yr)

Category	Surface Water				Groundwater				Total Withdrawals					
	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	AF Saline	AF Total	Percent Total Use	AF Fresh	Percent Total Use	AF Saline	Percent Total Use	AF Total	Percent Total Use
Public Water Supply	87,752	-	87,752	30%	205,715	-	205,715	70%	293,467	100%	-	-	293,467	9%
Industrial	-	-	-	0%	3,811	-	3,811	100%	3,811	100%	-	-	3,811	0%
Irrigation	1,485,112	-	1,485,112	56%	1,175,312	-	1,175,312	44%	2,660,424	100%	-	-	2,660,424	82%
Livestock	2,522	-	2,522	7%	33,372	-	33,372	93%	35,894	100%	-	-	35,894	1%
Aquaculture	6,109	-	6,109	23%	20,929	-	20,929	77%	27,039	100%	-	-	27,039	1%
Mining†	19,550	-	19,550	12%	44,111	100,240	144,351	88%	63,662	39%	100,240	61%	163,901	5%
Thermoelectric power	30,637	-	30,637	82%	6,872	-	6,872	18%	37,509	100%	-	-	37,509	1%
Domestic	-	-	-	0%	27,621	-	27,621	100%	27,621	100%	-	-	27,621	1%
Totals	1,631,683	-	1,631,683	50%	1,517,744	100,240	1,617,984	50%	3,149,427	97%	100,240	3%	3,249,667	100%

Source: Source: Dieter et al. 2017; updated with additional information provided to the BLM from the NMOSE regarding water use of the Navajo Power Plant (BLM 2019).

† Approximately 19,550 AF of the freshwater use within the Mining industry is from surface water; the remainder of all other water use is from groundwater. The Mining category includes the following self-supplied enterprises that extract minerals occurring naturally in the earth's crust: solids, such as potash, coal, and smelting ores; liquids, such as crude petroleum; and gases, such as natural gas. This category includes water used for oil and gas production (well drilling and secondary recovery of oil), quarrying, milling (crushing, screening, washing, flotation, etc.), and other processing done at the mine site or as part of a mining activity, as well as water removed from underground excavations (mine dewatering) and stored in—and evaporated from—tailings ponds. The Mining category also includes water used to irrigate new vegetative covers at former mine sites that have been reclaimed. It does not include the processing of raw materials, such as smelting ores, unless this activity occurs as an integral part of a mining operation and is included in an NMOSE permit.

Table 3-11 2015 State of New Mexico Water Use Associated with Oil and Gas Development (AF/yr)

County	Surface Water	Groundwater	Total	Percent of Total
Bernalillo	0	7	7	0%
Chaves	0	84	84	2%
Eddy	0	2,635	2,635	65%
Lea	0	1,275	1,275	32%
San Juan	30	0	30	1%
Sierra	0	1	1	0%
State Total	**30**	**4,002**	**4,032**	**100%**

NMOSE 2019.

Water Use Associated with Reasonably Foreseeable Oil and Gas Development

The reasonable foreseeable development (RFD) scenario for the BLM New Mexico Pecos District (Engler and Cather 2012, 2013, 2014) was developed as a reasonable estimate of development associated with hydrocarbon production in southeast New Mexico for the next 20 years in the New Mexico portion of the Permian Basin. The RFD is a comprehensive study of all existing plays and an analysis of recent activity, historical production, emerging plays for future potential, and completion trends. Table 3-12 presents planning factors from the RFD.

Table 3-12 RFD Planning Factors

Factor	RFD
Time Frame	2015–2035
Number of wells	16,000 (approximately 800 per year, federal and non-federal)
Average Water Use, Horizontal Well	7.3 AF (2.4 million gallons)
Average Water Use, Vertical Well	1.53 AF (500,000 gal)
Number of Wells Needed for Reservoir Development (play)	4 wells per section per play (horizontal wells)
Percentage of horizontal wells in Bone Spring Formation	84% horizontal
Percentage of horizontal wells in Leonard Formation	14% horizontal

As shown in the table above, the RFD concluded that the average water use for a single horizontal well was 7.3 AF. This figure was based on a study of the Bone Springs formation using data from 2013. Since that time, an estimate of 34.4 AF/horizontal well for the Permian Basin in 2016 was provided by Kondash et. al. (2018). The report concluded that "…the Permian Basin (Texas and New Mexico) had the largest increase in water use (770 percent), from 4900 m^3 per well (3.97 AF) in 2011 to 42500 m^3 per well (34.4 AF) in 2016" (Kondash et al. 2018). Because of this new information, BLM conducted studies using calendar year 2017 and 2018 data from FracFocus, a national hydraulic fracturing chemical registry managed by the Ground Water Protection Council and Interstate Oil and Gas Compact Commission, to provide objective information on hydraulic fracturing. Operators are required by the State of New Mexico to disclose chemistry and water use information on FracFocus.

Reported water use in 2017 was 13,962 AF of which 21 percent (2,959 AF was associated with federal wells (FracFocus 2017). Reported water use in 2018 was 21,742 AF of which 32 percent (6,936 AF was associated with federal wells (FracFocus 2018). These figures are higher than 2015 reported oil and gas water use (see Table 3-11) and corroborates that water use associated with hydraulic fracturing in the Permian Basin has been increasing in recent years. Analysis of the 2017 data set, consisting of 522 records, resulted an expected value of 26.9 AF, standard deviation of 17.47 AF, and a median of 24.78 AF. Analysis of the 2018 data set, consisting of 696 records, resulted in a mean of 31.2, standard deviation of 18.8 AF, and a median of 27.98 AF. As a result of these studies, the BLM considers the estimate of 31.2 AF as the best current estimate of water use per horizontal well in the Pecos District.

Note that if more water-intensive stimulation methods (e.g., slickwater fracturing) are implemented or if laterals become longer, water use could increase from this estimate). Alternatively, water use estimates could be lower if produced water is reused or recycled for use in hydraulic fracturing. Public concern about water use from hydraulic fracturing is especially high in semiarid regions, where water withdrawals for hydraulic fracturing can account for a significant portion of consumptive water use within a given region. The BLM will continue to evaluate reported water use in FracFocus and other data and will revise water use estimates to be used in NEPA evaluations accordingly.

3.2.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Water use per horizontal well is estimated to be 31.2 AF/horizontal well for the Permian Basin. Vertical well water use is estimated to be 1.53 AF per well. See Table 3-12 for additional water use assumptions. The total water use for this action can be found by multiplying the number of wells in section 2.1 by 31.2 AF for horizontal well or 1.53 AF for vertical well.

Cumulative Water Use Estimates

Past and Present Actions

Pecos District total water usage (620,416 AF) accounted for about 19 percent of the total state withdrawals. Mining (which includes oil and gas development) comprises approximately 15 percent of Pecos District water withdrawals. Water use associated with oil and gas development (4,032 AF) comprises approximately 2.5 percent of the statewide Mining water use (163,901 AF), 4.3 percent of the Pecos District Tri-County Area Mining water use (94,758 AF), and 0.7 percent of Pecos District total water usage. The largest water use of water within the county and the state is agricultural, comprising 75% of all water use within the Pecos District and 82% percent of all water use within the state. This trend is expected to continue.

The BLM examined FracFocus to ascertain water use, cumulative water use, and water use trends in the New Mexico portion of the Permian Basin that is for Chaves, Eddy, and Lea counties-Table 3-13.

Table 3-13 Actual Water Use in the NM portion of the Permian basin for Calendar Years 2014-2018

Year	Federal Water Use	Non-Federal Water Use	Total WU	%FedWU	FedCUMWU	TotCUMWU	Average WU/Well	Total # of Wells Reported to Frac Focus
2014	1307	2509	3816	34.25	1307	3816	6.82	559
2015	4033	4336	8369	48.19	5340	12185	15.82	529
2016	710	6091	6801	10.44	6050	18986	21.66	314
2017	2964	11418	1482	20.61	9014	33368	26.44	544
2018	8411	19681	28092	29.94	17425	61460	31.04	905
	17425	44035	61460					2851

Figure 3 shows the total actual water use per year in the basin, it has increased from 6801 AF in 2016 to 28092 AF in 2018, with a corresponding basin-wide average water use per well increase from 22 AF/well to 31 AF/well (FracFocus, 2019). The Figure 5 shows the cumulative water use per year in the basin. A cumulative total of 61460 AF was used for oil and gas in HF for the years 2014-2018. Total federal cumulative water use in the basin, for the same time period was 17425 AF (Figure 4), a percentage of 28% of the total water use. The total number of wells that were reported to FracFocus, for 2016 to 2018, also increased from 314 to 905 wells.

Figure 3 Permian Basin Total Cumulative Actual Water Use

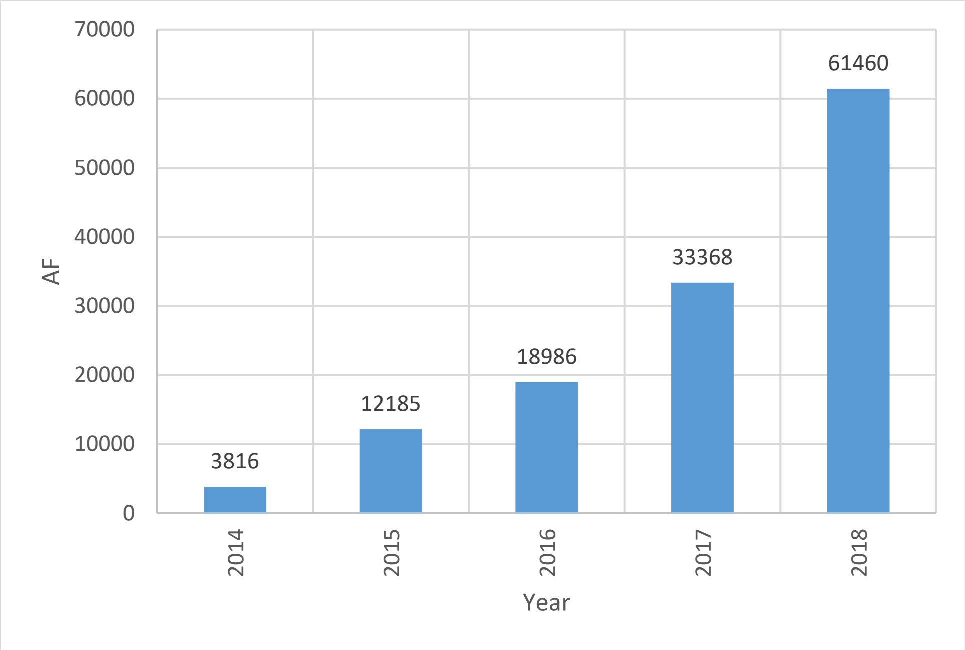


Figure 4 Permian Basin Federal Cumulative Actual Water Use compared to the RFD Scenario

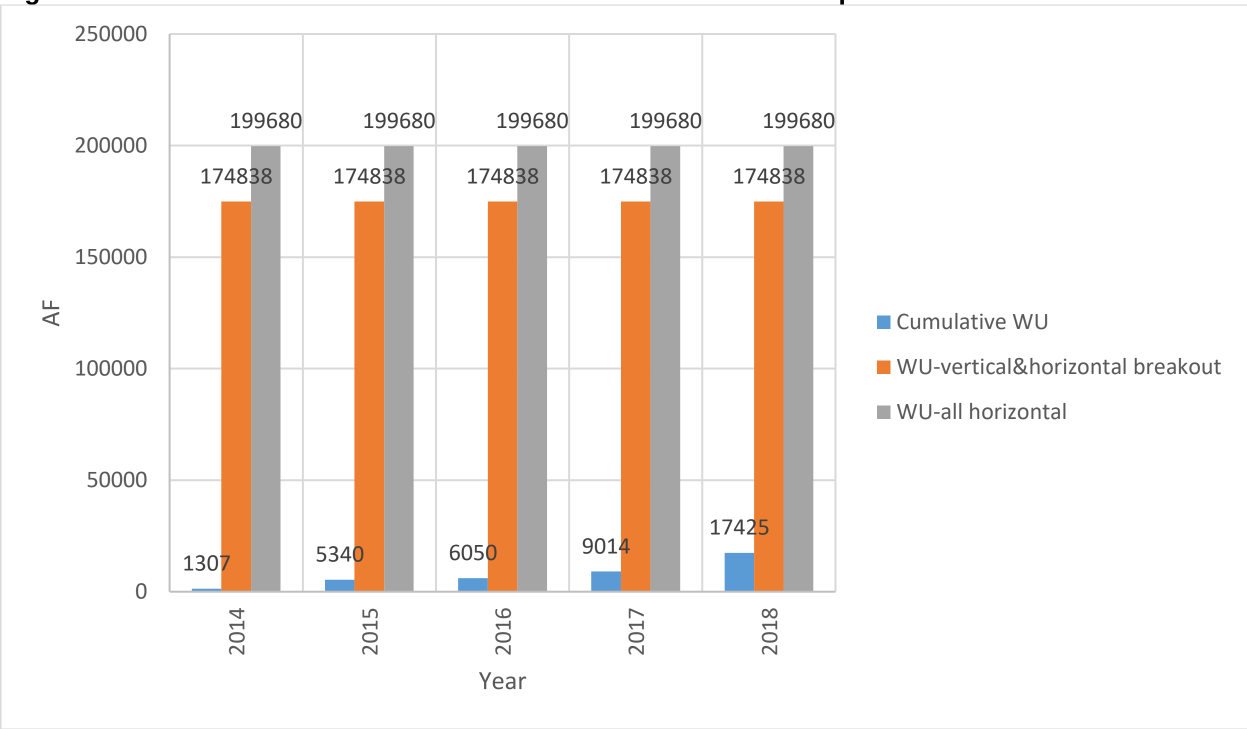
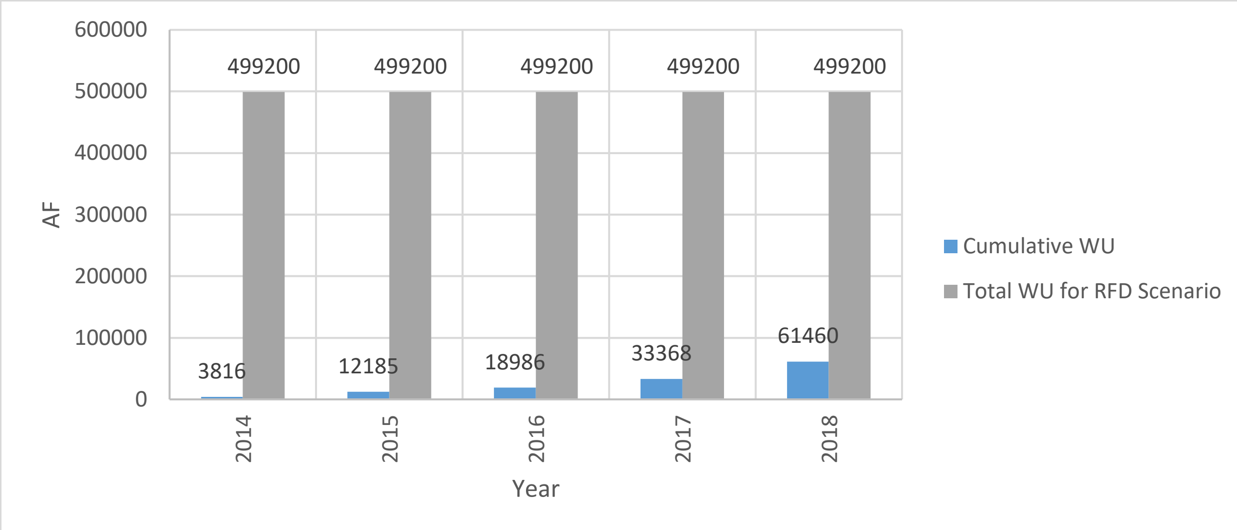


Figure 5 Permian Basin Total Cumulative Actual Water Use compared to the RFD Scenario



Water Use Associated with Reasonably Foreseeable Oil and Gas Development

Between 2012 and 2014, the BLM prepared an RFD scenario for the Pecos District that projected approximately 800 new wells per year, for a total of 16,000 wells over a 20-year period. With consideration of the revised water use estimates presented above (31.2 AF per well), development of the 16,000 wells projected in the RFD would require 499,200 AF water, or 24,960 AF of water in any given year. Well development associated with recent or reasonably foreseeable APDs or master development plans are included in the RFD.

Other Development

There are no mining RFFAs that would contribute to cumulative water withdrawals within the Pecos District (BLM 2019b). Some water use would be required during construction and operation of reasonably foreseeable transmission lines and pipelines, these uses are minimal and are not quantified in this analysis. Future water use for the other reported water use categories in the Pecos District is assumed to continue at current levels.

Cumulative Impacts

Development of all RFFAs would require 24,960 AF of water in any given year. This is about 4 percent of Pecos County 2015 total water withdrawals (620,416 AF, which already includes past and present actions). Agriculture would remain by far the largest water use within the county (currently 75% of all water use within the Pecos District and 82% percent of all water use within the state).

Potential Sources of Water for Project Development

The Pecos District contains a variety of surface waters, from springs and seeps to lakes, playas, rivers, and ephemeral drainages and draws. Waters from spring developments, reservoirs or streams, and stream diversions within the planning area are used primarily for irrigation, livestock, and wildlife. No surface waters used for domestic purposes originate on BLM-managed land. Diversions on BLM-managed lands support private land crop irrigation and stock water needs. Water use associated with oil and gas drilling is primarily from groundwater. Table 3-14 shows the potential sources of groundwater in Pecos District. Figure 6 is an idealized cross section of these aquifers. It is speculative to predict the actual source of water that would be used for development of the RFD (or the development of any specific lease sales). However, because approximately 88 percent of all water use and 100 percent of all mineral use in the Pecos District is currently from groundwater, it is reasonable to assume that water used for development of the RFD would likely be groundwater. Water used for oil and gas drilling and completion would be purchased legally from those who hold water rights in or around the Permian Basin.

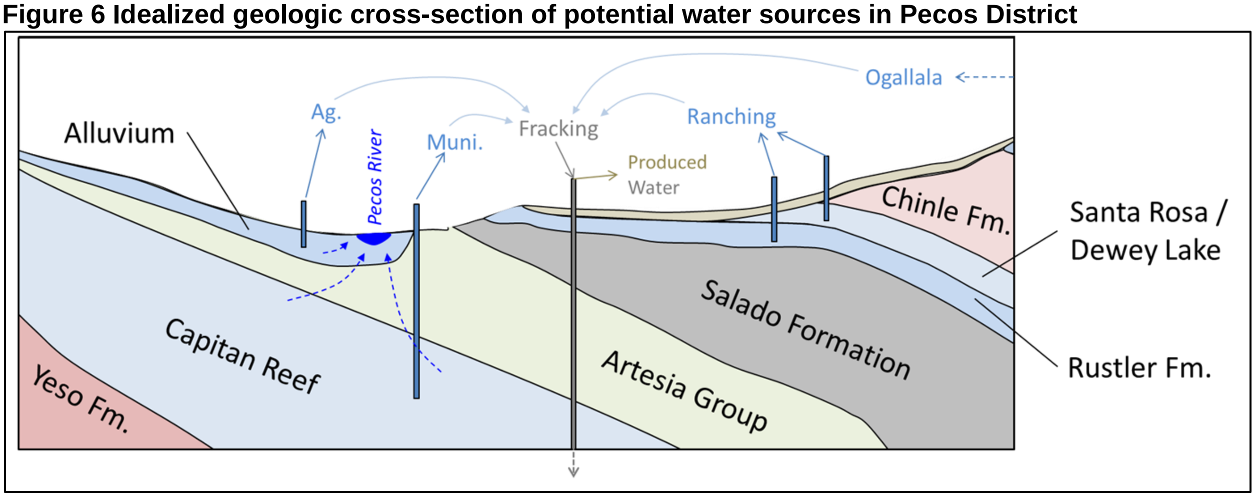
The transaction would be handled by the New Mexico Oil Conservation Division, as well as the New Mexico Office of the State Engineer.

Table 3-14 Potential Sources of Groundwater in Pecos District

Aquifer Name	Description
Pecos Valley Alluvium	Surficial deposits along the Pecos River. No known recharge areas.
Dewey Lake and Santa Rosa	Redbed sandstones. Inconsistent water source. Recharge occurs closer to the surface, as a result of weather events.
Rustler Formation (Culebra and Magenta)	Dolomite, fractured and dissolution zones. Local recharge occurs, largely as a result of weather events.
Capitan Reef	Limestone, Karstic formation. Good quality west of the Pecos, low quality towards the east. Recharge in the west occurs mainly in the vicinity of the Guadalupe Mountains. Recharge in the east occurs in the vicinity of the Glass Mountains (in Texas). The New Mexico portion of the eastern part of the Capitan Reef is recharging at a high rate
Ogallala	Sand and gravel. Offsite aquifer where water imported to area.

Source: Lowry et al 2018.

Figure 6 Idealized geologic cross-section of potential water sources in Pecos District



Source: Summers 1972.

A recent study conducted by Sandia National Laboratory (Lowry et al. 2018) was completed in portions of Eddy and Lea counties that were identified as having of high potential for oil and gas development in the RFD. The study was undertaken to establish a water-level and chemistry baseline and develop a modeling tool to aid the BLM in understanding the regional water supply dynamics under different management, policy, and growth scenarios and to pre-emptively identify risks to water sustainability. The following section summarizes key information in that report related to groundwater sources.
Four high potential areas (HPAs) were studied. The HPAs were associated with the Alto Platform, Bone Spring, and Delaware Mountain Group plays, and were limited the extent of each to development on federal lands managed by the BLM.

Most of the wells that were sampled in each HPA appeared to have a mix of source waters and establishing definitive signatures for each aquifer was not possible. However, evidence shows that the main water source for wells in the North HPA (which included Loco Hills and areas along the Pecos River) are from the Dewey Lake and Santa Rosa aquifer or another perched source in the host Dockum

Formation. For the Center North HPA (which encompasses a region known as Burton Flats), the main sources are from the Dewey Lake and Santa Rosa aquifer and the Rustler Formation. For the South HPA (located near Malaga and Loving), the main water sources are the Dewey Lake and Santa Rosa aquifer. The east HPA, which primarily represents the Ogallala aquifer, was excluded from the study because only a small percentage of the land is managed by the BLM and because the aquifer is heavily pumped for agricultural purposes throughout several states, which would require a broader study of the overall aquifer (Lowry et al. 2018). The study also sampled wells that access water from the Capitan Reef, located near the community of Carlsbad.
Select wells were also monitored using both continuous and manual water level measurements throughout the study:

- Water levels in the two sampling water wells located in the North HPA fluctuated only slightly (>1 pounds per square inch [psi]) and carried no obvious trend, indicating a high likelihood that the water level variations are naturally occurring through seasonal and barometric pressure fluctuations.
- Of the two monitoring wells located in the Center North HPA, one showed only show water level changes suggestive of barometric effects and seasonal change; the other well displayed a sharp water level increase. The cause of this change is conjectured to be from active drilling, pumping, or injecting near the well.
- Of the 16 wells monitoring the South HPA:
  - 2 wells showed minimal water level change with a slight increasing trend over time, indicating that the aquifer is not being locally impacted by pumping or aquifer development.
  - 2 wells showed pressure variations that are typical to nearby pumping. One well was located near a known oil supply well which is the likely driver to the drawdown and recovery response; the other was located near a municipal water supply well and its erratic response is indicative of pumping cycles associated with a small community water supply.
  - 5 wells displayed water level changes that are typical for aquifers affected by seasonal variations in pressure and barometric effects.
  - 3 wells showed minor water level changes likely due to activity in adjacent wells. The origin of the aquifer activity affecting each well are unknown, but likely due to oilfield drilling activities.
  - 1 well had drastic changes in water level as a result of nearby pumping tests conducted as part of monitoring of the Waste Isolation Pilot Plant.
  - 3 wells displayed water level changes due to high production pumping by a local ranch.
- Of the five wells monitoring the Capitan Reef, two wells recorded pressure decreases. The source of the pressure change is undetermined, however it is likely these wells are influenced by precipitation given their shallow depth and the karstic nature of the formation, as well as from localized municipal pumping by the City of Carlsbad. The remaining 3 wells recorded water levels increasing at a relatively constant rate. This suggests that the aquifer in the eastern part of the Capitan is experiencing recharge

A model is being developed as part of the Sandia Report to simulates water availability over a range of different future scenarios, including drilling activity and water demand relative to identify areas that are most vulnerable and to estimate the risk to water sustainability. The model is still under development, but when completed, it will allow BLM to look at the balances between water demand and water availability to predict and track both risks to each aquifer as well as calculate well drawdown. The intent is to screen future water extraction that may be unsustainable. The Carlsbad FO will have the capacity to apply this model during future NEPA actions.

Water Use Mitigation Measures

Overall, there have been calls to increase the use of alternative water sources such as brackish water or recycling produced water, minimizing the strain on local freshwater resources (Kondash et al. 2018). The BLM encourages the use of recycled water in hydraulic fracturing techniques but does not have the ability to require this as mitigation.

Moreover, recent studies indicate that the water used for hydraulic fracturing may be retained within the shale formation, with only a small fraction of the fresh water injected into the ground returns as flowback water; water returning to the surface is highly saline, is difficult to treat, and is often disposed through deep-injection wells (Kondash et al. 2018). Thus, the ability to recycle water may be more limited than previously reported. Note that water use calculations above do not assume the use of recycled water.

3.2.2 Affected Environment

Water Quality

Groundwater

As noted in Section 3.2.3, the BLM contracted with Sandia National Laboratory to prepare a report (Lowry et al. 2018) on water sustainability in Pecos District related to oil and gas development. The following section summarizes key information in the report related to groundwater quality.

Groundwater quality in Eddy and Lea Counties and in the Lower Pecos Valley varies considerably depending on the aquifer and location. In general, groundwater on the west side of the Pecos River is fresher than east of the Pecos River. East of the Pecos River, salinity is higher and can reach concentrations of 35,000 milligrams per Liter (mg/L). Shallow groundwater quality can be very good in the alluvial aquifers, but of poor quality in deeper geologic formations due to the presence of salt, gypsum, and other evaporite deposits. Groundwater tends to be mineralized or ‘hard’ west of the Ogallala aquifer (Lowry et al. 2018). Typical ranges of total dissolved solids (TDS) along with the general aquifer materials are shown in Table 3-15.

Table 3-15 Typical TDS Ranges Found in the Main Aquifers of the Pecos District

Aquifers	Aquifer Material	Typical TDS Range (mg/L)
Pecos	Alluvium	<200 to 10,000
Rustler (includes Culebra and Magenta)	Carbonates and Evaporites	<1,000 to 4,600
Dockum (includes Dewey Lake and Santa Rosa)	Sandstone and Conglomerates	<5,000 to >10,000
Capitan Reef	Dolomite and Limestone	300 to >5,000

Source: Lowry et al. 2018.

Overall 30 wells in the South HPA, 11 wells in the Center North HPA, and 19 wells in the North HPA were selected for water quality analysis. The predominant water types for each of the HPAs and the Capitan Reef are listed below

1. North – calcium and magnesium dominant
2. Center-North – sodium and calcium dominant
3. South – sodium and calcium dominant
4. Waste Isolation Pilot Plant (WIPP) – sodium and chloride dominant
5. Capitan Reef – sodium dominant

The samples were also compared to the New Mexico Water Quality Control Commission (NMWQCC) human health, domestic water supply, and irrigation use standards for groundwater with a TDS concentration of 10,000 mg/L or less (20.6.2.3103 NMAC). Table 3.16 presents a listing of the sampled water quality parameters by HPA against the NMWQCC standards for drinking water.

Table 3-16 Sampled Water Quality Parameters Against NMWQCC Drinking Water Standards

Parameter	NMWQCC Standard	North HPA	Central North HPA	South HPA and WIPP	Capitan Reef
pH (pH units)	6 to 9	7.07 - 7.97	7.53 - 7.97	6.18 - 8.59	8.08 - 8.86
Specific Conductance (µmhos/cm)	--	1000 - 3905	1300 - 83000	600 - 270000	2770 - 174500
Total Dissolved Solids (TDS)	1000	331 - 3550	869 - 43000	322 - 330000	1951 - 141875
Calcium (Ca2+)	--	0.73 - 590	2.6 - 920	0.7 - 1900	1.4 - 5902
Magnesium (Mg2+)	--	23 - 200	44 - 1492	2.10 - 10000	82.26 - 1420
Sodium (Na+)	--	18 - 262	92.58 - 12000	26 - 95000	225 - 46700
Potassium (K+)	--	0 - 30	4 - 1136	0 - 21000	6.58 - 3352
Chloride (Cl-)	250	16 - 1000	97 - 21000	11 - 190000	388.80 - 82602.1

Alkalinity ($CaCO_3$)	--	139 - 312	19.9 - 181.2	23 - 297.10	18.53 - 250.10
Bicarbonate (HCO_3^-)	--	139 - 312	19.8 - 181.2	39.72 - 297.10	18.74 - 249.27
Carbonate (CO_3^-)	--	0 - <2	0 - <2	0 - 16.08	0 - 0.83
Sulfate (SO_4^{2-})	600	0 - 1900	306.71 - 6400	0 - 15000	0 - 1975.67
Fluoride (F^-)	1.6	0 - 1.3	0.82 - 2.60	0.00 - 3.63	0.09 - 0.52
Nitrite (NO_2)	10	0 - 6.27	0 - 8.8	0.00 - 20.08	0.05 - 7.60
Nitrate (NO_3)	10	0 - 10	2.6 - 8.8	0 - 19	0.04 - 7.60
Silver (Ag)	0.05	--	--	--	0
Aluminum (Al)	5	--	0.18	0 – 4.06	--
Arsenic (As)	0.1	0.02 – 0.06	0.03 - 0.32	0 – 0.29	0.10
Barium (Ba)	1	0.01 – 0.13	0.01 - 0.03	0- 0.1	0.02 - 0.25
Bromide (Br)	--	0 - 7.8	0.28 - 12.00	0 - 1400	0.3 - 12.73
Cadmium (Cd)	0.01	--	--	--	--
Copper (Cu)	1	0.02	0.03	0.06 - 0.37	--
Iron (Fe)	1	3.34	0.04	0.01 - 1.62	3.41
Lithium (Li)	--	0.14 - 1.70	0.140 - 1.695	0.05 - 0.85	0.04 - 4.49
Manganese (Mn)	0.2	0 - 0.06	0 - 0.20	0 - 0.06	0 - 7.61
Nickel (Ni)	0.2	--	0 - 0.02	0 - 0.01	0.01
Lead (Pb)	0.05	0.04	--	0.02 - 0.06	--
Silicon (Si)	--	2.67 - 18.38	1.9 - 23.4	4.91 - 47.0	0 - 7.10
Strontium (Sr^{2+})	--	0.63 - 8.47	2.73 - 13.75	0.05 - 32.0	2.52 - 104.8
Vanadium (V)	--	--	0.01 - 0.03	0 - 0.1	--

Source Lowry et al. 2018. Units are milligrams per liter (mg/L) unless otherwise noted. "—" = not applicable or not detected. Values rounded to two decimal places.

Key observations related to the comparison of results to the standards:

- Seventeen of the water quality parameters analyzed have applicable NMWQCC standards, including pH, TDS, Cl^-, SO_4^{2-}, F^-, NO_3^-+ NO_2^-, Ag, Al, As, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Pb

No exceedances were observed for eight of the parameters with NMWQCC standards, including pH, Ag, Al, Ba, Cd, Cr, Cu, and Ni.

Surface Water

Stream and river conditions vary widely, from completely undisturbed river and vegetative communities in the mountainous highlands, to deep, erodible soil banks at lower elevations where livestock, recreationists, and other public users have access to stream and riverbanks.

Water quality in streams flowing on BLM-managed land is influenced by both natural water quality with regard to salinity content and the intensity of human and industrial activity in the watershed. For example, water quality may be vastly different in a remote mountain spring creek than in waters with natural brine discharge, or where there are human impacts due to urban, farming, ranching, or industrial activity. Chemistry samples of surface water in the planning region are needed in order to establish a baseline chemistry data for the waters. Variances in baseline chemistry can indicate water quality changes attributable to land use development. The most common pollutants for waters in the planning area are sediment and mercury. Beneficial uses listed for these waters are industrial water supply, irrigation storage, livestock watering, recreation, warm water fishery, and wildlife habitat. The dominant legislation affecting national water quality and BLM compliance with New Mexico water quality requirements is the Clean Water Act (CWA) or Federal Water Pollution Control Act. Within the planning area, total maximum daily loads (TMDLs) determinations are not in place for any of the watersheds with 303(d)-listed streams. Thus, an assessment of their condition via this metric is not possible at the time.

3.2.3 Impacts from the Proposed Action

Potential Water Sources of Surface Water or Groundwater Contamination

Spills

Spills associated with oil and gas development may reach surface water directly during the spill event. Spills may also reach surface waters indirectly, when the spill has occurred, and a rain event moves contaminants into nearby surface water bodies through surface water flow or even subsurface groundwater flow into springs that discharge into a surface water body.
There are approximately 15,660 federal wells within the New Mexico portion of the Permian Basin. planning area (BLM 2019). As shown in Table 3-17, there were a total of 1,261 spills in the Permian Basin in 2018. The rate of recovery varies by spill type but in generally, most spills are not recovered. No spills occurring in the Pecos District were reported as having affected surface or groundwater.
The BLM works with the NMOCD to remediates spills on public BLM lands. Per NMAC 19.15.29.11, the responsible person shall complete division-approved corrective action for releases that endanger public health or the environment in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with 19.15.30 NMAC. The remaining contaminates from unrecovered spills are remediated in accordance with federal and state standards. Some remediation consists of removing contaminated soil and replacement with uncontaminated soil and corresponding chemical testing.

Drilling and Completion Activities

The BLM and State of New Mexico Oil Conservation Division (NMOCD) has casing, cementing, and inspection requirements in place to limit the potential for groundwater reservoirs and shallow aquifers to be impacted by fracking or the migration of hydrocarbons on the nominated lease parcels. Prior to approving an APD, a BLM geologist would identify all potential subsurface formations that would be penetrated by the wellbore including groundwater aquifers and any zones that would present potential safety or health risks that would need special protection measures during drilling, or that could require specific protective well construction measures. Casing programs and cement specifications would be submitted to the BLM and NMOCD for approval to ensure that well construction design would be adequate to protect the subsurface environment, including known or anticipated zones with potential risks or zones identified by the geologist. Surface casing would be set to an approved depth, and the well casing and cementing would stabilize the wellbore and provide protection to any overlying freshwater aquifers by isolating hydrocarbon zones from overlying freshwater aquifers. Before hydraulic fracturing takes place, all surface casings and intermediate zones would be required to be cemented from the bottom of the cased hole to the surface. The cemented well would be pressure tested to ensure there are no leaks, and a cement bond log would be run to confirm that the cement has bonded to the steel casing strings and to the surrounding formations.

Water Quality Mitigation Measures

Spills

Secondary containment of production facilities as required on the Conditions of Approval. Best Management Practices for leak detection systems and berming to prevent spills from leaving the pad.

Table 3-17 Summary of 2018 Spills in the New Mexico Portion of the Permian Basin

Material Type	Count of Spills	Volume Spilled	Volume Lost	Units	% Lost
Acid	1	20	1	Barrels	5%
Basic sediment and water (BS&W)	5	19	9	Barrels	47%
Brine Water	3	1,570	1,531	Barrels	98%
Chemical	9	1,342	1,165	Barrels	87%
Condensate	13	405	258	Barrels	64%
Crude Oil	435	15,388	6,595	Barrels	43%
Diesel	3	24	16	Barrels	67%
Drilling Mud/Fluid	6	615	353	Barrels	57%
Other	26	15,049	14,060	Barrels	93%
Produced Water	606	90,931	44,775	Barrels	49%
Sulphuric Acid	1	20	15	Barrels	75%
Total	**1,108**	**125,383**	**68,778**	**Barrels**	**55%**
Natural Gas (Methane) and Natural Gas Liquids	153	144,813	144,813	MCF	100%
Total Number of Spills	**1,261**				

NMOCD 2019.

Drilling and Completion Activities

The BLM requires operators to comply with the regulations at 43 Code of Federal Regulations (CFR) 3160. These regulations require oil and gas development to comply with directives in the Onshore Orders and the orders of the Authorized Officer. Onshore Order No. 2 and the regulations at 43 CFR 3162.3-3 provide regulatory requirements for hydraulic fracturing, including casing specifications, monitoring and recording, and management of recovered fluids. The State of New Mexico also has regulations for drilling, casing and cementing, completion, and plugging to protect freshwater zones (19.15.16 New Mexico Administrative Code). Complying with the aforementioned regulations require producers and regulators to verify the integrity of casing and cement jobs. Casing specifications are designed and submitted to the BLM together with an APD. The BLM petroleum engineer independently reviews the drilling plan, and based on site-specific geologic and hydrologic information, ensures that proper drilling, casing and cementing procedures are incorporated in the plan in order to protect usable groundwater. This isolates usable water zones from drilling, completion/hydraulic fracturing fluids, and fluids from other mineral bearing zones, including hydrocarbon bearing zones. Conditions of Approval (COAs) may be attached to the APD if necessary to ensure groundwater protection. Installation of the casing and cementing operations are witnessed by certified BLM Petroleum Engineering Technicians. At the end of the well's economic life, the operator must submit a plugging plan, which undergoes review by the BLM petroleum engineer prior to well plugging, which ensures permanent isolation of usable groundwater from hydrocarbon bearing zones. BLM inspectors ensure planned procedures are properly followed in the field. Surface casing and cement would be extended beyond usable water zones. Production casing will be extended and adequately cemented within the surface casing to protect other mineral formations, in addition to usable water bearing zones. These requirements ensure that drilling fluids, hydraulic fracturing fluids, and produced water and hydrocarbons remain within the well bore and do not enter groundwater or any other formations. Since the advent of hydraulic fracturing, more than 1 million hydraulic fracturing treatments have been conducted, with perhaps only one documented case of direct groundwater pollution resulting from injection of hydraulic fracturing chemicals used for shale gas extraction (Gallegos and Varela 2015). Requirements of Onshore Order #2 (along with adherence to state regulations) make contamination of groundwater resources highly unlikely and there have not been any documented past instances of groundwater contamination attributed to well drilling. This is an indication of how effective the use of casing and cement is at preventing leaks and contamination.

3.4. Watershed Resources

3.3.1 Affected Environment

The area of the proposed action occurs within the Rock Lake Watershed (HUC10-1307000704), and drains west into a wetland area known as a playa, approximately 0.22 miles away. A playa is a dry, vegetation-free, flat area at the lowest part of an undrained desert basin. It is a location where ephemeral lakes form during wet periods, and is underlain by stratified clay, silt, and sand, and commonly, soluble salts (Stoffer 2004). A playa is important for aquifer/ground water recharge and important habitat for local wildlife and migratory birds. Playas typically form in karst areas where underlying caverns and cave passages have subsided, but playas can also form in depressions in the landscape. This unique landscape feature allows for a higher rate of recharge to the water table than land not associated with playas (Gurdak and Roe 2009).

Playa hydrology is characterized by cycles of drying out and filling with rain or melting snow. Standing water in the playas provides seasonal drinking water for wildlife and livestock, but the increased moisture that accumulates in these low lying areas greatly improves plant life, which in turn supplies increased food and nesting opportunities for wildlife year-round.

Playas are also characterized by having a vegetated filter strip or buffer around the circumference of the depression. A playa buffer may be 1 to greater than 200 meters in width and is a transition zone between the upland and wetland ecosystem (Melcher and Skagen 2005). A properly functioning buffer zone has the ability to protect the playa from the adverse effects of sediments, contaminants and excessive erosion, while maintaining proper recharge to ground water, providing abundant habitat for birds, wildlife and other aquatic organisms and producing abundant, high quality forage for livestock and wildlife.

As a result of their water-holding capacity in the arid region of southeast New Mexico, playas support many exclusive plant species as well as provide habitat for many local wildlife, crucial winter habitats for waterfowl and cranes, migration stopover habitats for waterbirds, shorebirds and songbirds and breeding habitats for waterfowl, grassland raptors, shorebirds, and passerines (Curtis and Beierman 1980).

Impacts from the Proposed Action

Direct and Indirect Impacts

Ephemeral surface water from local rain events will flow down-slope through the area of the proposed action. Localized decreases in vegetative surface cover combined with the caliche covering the pad and road could result in decreased infiltration rates and increased runoff volume and velocity. This causes increased erosion, top soil loss, and sedimentation.

The construction and development associated with oil and gas exploration and/or development near the playa could adversely impact this wetland resource. Erosion and sediment loading can both contribute greatly to the decline of a properly functioning playa and associated buffer, which would adversely affect water quality and quantity, wildlife habitat and foraging availability. Possible wildlife mortality; habitat degradation and fragmentation; avoidance of habitat during construction and drilling activities due to increased noise; and the potential loss of nests and burrows could result from oil and gas development near the playa wetland. Contamination of the soil and water in or near the playa would affect the health of both plants and animals using this natural water source.

Playas associated with karst features also provide direct recharge points leading to groundwater. These points can quickly transport surface and subsurface contaminants directly into underground water systems and freshwater aquifers without filtration or biodegradation. The water quality can be adversely affected following the occurrence of an undesirable event such as a leak or spill during the drilling of the oil or gas well or its subsequent production and development.

Standard practices or design features of the proposed project that minimize impacts to the watershed, water quality and wildlife habitat include: utilizing a closed loop system with no reserve pits, utilizing existing surface disturbance, minimizing the well pad and access road total surface disturbance, minimizing vehicular use, surfacing parking and staging areas with caliche and reclaiming the areas not necessary for production and quickly reestablishing vegetation on the reclaimed areas.

Mitigation Measures and Residual Impacts

The entire well pad(s) will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad. The compacted berm shall be constructed at a minimum of 12 inches with impermeable mineral material (e.g. caliche). Topsoil shall not be used to construct the berm. No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad. The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed. Any water erosion that may occur due to the construction of the well pad during the life of the well will be quickly corrected and proper measures will be taken to prevent future erosion. Stockpiling of topsoil is required. The topsoil shall be stockpiled in an appropriate location to prevent loss of soil due to water or wind erosion and not used for berming or erosion control. If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.

Any water erosion that may occur due to the construction of the well pad during the life of the well will be quickly corrected and proper measures will be taken to prevent future erosion. Stockpiling of topsoil is required. The top soil shall be stockpiled in an appropriate location to prevent loss of soil due to water or wind erosion and not used for berming or erosion control.

TANK BATTERY:
Tank battery locations will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank or 24 hour production, whichever is greater. Automatic shut off, check valves, or similar systems will be installed for tanks to minimize the effects of catastrophic line failures used in production or drilling.

BURIED/SURFACE LINE(S):
When crossing ephemeral drainages the pipeline(s) will be buried to a minimum depth of 48 inches from the top of pipe to ground level. Erosion control methods such as gabions and/or rock aprons should be placed on both up and downstream sides of the pipeline crossing. In addition, curled (weed free) wood/straw fiber wattles/logs and/or silt fences should be placed on the downstream side for sediment control during construction and maintained until soils and vegetation have stabilized. Water bars should be placed within the ROW to divert and dissipate surface runoff. A pipeline access road is not permitted to cross these ephemeral drainages. Traffic should be diverted to a preexisting route. Additional seeding may be required in floodplains and drainages to restore energy dissipating vegetation.

Prior to pipeline installation/construction a leak detection plan will be developed. The method(s) could incorporate gauges to detect pressure drops, situating valves and lines so they can be visually inspected periodically or installing electronic sensors to alarm when a leak is present. The leak detection plan will incorporate an automatic shut off system that will be installed for proposed pipelines to minimize the effects of an undesirable event.

ELECTRIC LINE(S):
Any water erosion that may occur due to the construction of overhead electric line and during the life of the power line will be quickly corrected and proper measures will be taken to prevent future erosion. A

power pole should not be placed in drainages, playas, wetlands, riparian areas, or floodplains and must span across the features at a distance away that would not promote further erosion.

TEMPORARY USE FRESH WATER FRAC LINE(S):
Once the temporary use exceeds the timeline of 180 days and/or with a 90 day extension status; further analysis will be required if the applicant pursues to turn the temporary ROW into a permanent ROW.

3.5. Soils

3.4.1. Affected Environment

The area of the proposed action is mapped as Pu-Pyote and Maljamar fine sands and PY- Pyote soils and Dune land. These are sandy soils and are described below:

Typically, these soils are deep, well-drained to excessively drained, non-calcareous to weakly calcareous sands. They are found on undulating plains and low hills in the "sand country" east of the Pecos River. Permeability is moderate to very rapid, water-holding capacity is low to moderate, and little runoff occurs. These soils are susceptible to wind erosion and careful management is needed to maintain a cover of desirable forage plants and to control erosion. Reestablishing native plant cover could take 3-5 years due to unpredictable rainfall and high temperatures.

Low stability soils, such as the sandy and deep sands found on this area, typically contain only large filamentous cyanobacteria. Cyanobacteria, while present in some locations, are not significant. While they occur in the top 4 mm of the soil, this type of soil crust is important in binding loose soil particles together to stabilize the soil surface and reduce erosion. The cyanobacteria also function in the nutrient cycle by fixing atmospheric nitrogen, contributing to soil organic matter, and maintaining soil moisture. Cyanobacteria are mobile, and can often move up through disturbed sediments to reach light levels necessary for photosynthesis. Horizontally, they occur in nutrient-poor areas between plant clumps. Because they lack a waxy epidermis, they tend to leak nutrients into the surrounding soil. Vascular plants such as grasses and forbs can then utilize these nutrients.

3.4.2. Impacts from the Proposed Action

There is a potential for wind and water erosion due to the erosive nature of these soils once the cover is lost. There is always the potential for soil contamination due to spills or leaks. Soil contamination from spills or leaks can result in decreased soil fertility, less vegetative cover, and increased soil erosion.

The biological soil crusts are susceptible to compressional damage, which is due to vehicle traffic. Disruption of the crust can result in decreased soil organism diversity, soil nutrient levels, soil stability, and organic matter. These impacts are expected to be limited to new oil and gas roads, pipeline right-of-ways and well pads.

Impacts to soil resources are reduced by standard practices such as utilizing existing surface disturbance, minimizing vehicular use, placing parking and staging areas on caliche surfaced areas, and quickly establishing vegetation on the reclaimed areas.

Mitigation Measures

- Surface with caliche.
- Interim reclamation will be conducted on all disturbed areas not needed for active support of production operations, and if caliche is used as a surfacing material it will be removed at time of reclamation to mitigate impacts to soil resources.
- Topsoil will be stockpiled to enhance reclamation.

3.6. Wildlife

3.5.1 Affected Environment

Affected Environment

This project occurs in the sand shinnery habitat type. Sand shinnery communities extend across the southern Great Plains occupying sandy soils in portions of north and west Texas, west Oklahoma, and southeast New Mexico. Portions of Eddy, Lea and Chaves counties consist largely of sand shinnery habitat and are intermixed with areas of mesquite to a lesser degree. The characteristic feature of these communities is co-dominance by shinnery oak and various species of grasses. In New Mexico Shinnery oak occurs in sandy soil areas, often including sand dunes.

Various bird, mammal, reptile and invertebrate species inhabit the sand shinnery ecosystem in New Mexico. Herbivorous mammals include mule deer, pronghorn, and numerous rodent species. Carnivores include coyote, bobcat, badger, striped skunk, and swift fox. Two upland game bird species, scaled quail and mourning dove, are prevalent throughout the sand shinnery in New Mexico. Many species of songbirds nest commonly, with a much larger number that use the habitat during migration or for non-nesting activities. Common avian predators include northern harrier, Swainson's hawk, red-tailed hawk, kestrel, burrowing owl, and Chihuahuan raven. Numerous snake and lizard species have been recorded, including the sand dune lizard, the only vertebrate species restricted entirely to sand shinnery habitat.

<u>Lesser Prairie-Chicken (Tympanuchus pallidicinctus)</u>

In New Mexico, the lesser prairie-chicken (LPC) formerly occupied a range that encompassed the easternmost one-third of the state, extending to the Pecos River, and 48 km west of the Pecos near Fort Sumner. This covered about 38,000 km^2. By the beginning of the 20^{th} Century, populations still existed in nine eastern counties (Union, Harding, Chaves, De Baca, Quay, Curry, Roosevelt, Lea, and Eddy). The last reliable records from Union County are from 1993. Currently, populations exist only in parts of Lea, Eddy, Curry, Chaves, and Roosevelt counties, comprising about 23% of the historical range.

LPC are found throughout dry grasslands that contained shinnery oak or sand sage. Currently, they most commonly are found in sandy-soiled, mixed-grass vegetation, sometimes with short-grass habitats with clayey or loamy soils interspersed. They occasionally are found in farmland and smaller fields, especially in winter. Shinnery oak shoots are used as cover and produce acorns, which are important food for LPC and many other species of birds, such as the scaled quail, northern bobwhite, and mourning dove. Current geographic range of shinnery oak is nearly congruent with that of the lesser prairie-chicken, and these species sometimes are considered ecological partners. Population densities of LPC are greater in shinnery oak habitat than in sand sage habitat.

LPC use a breeding system in which males form display groups. These groups perform mating displays on arenas called leks. During mating displays male vocalizations called booming, attract females to the lek. Leks are often on knolls, ridges, or other raised areas, but in New Mexico leks are just as likely to be on flat areas such as roads, abandoned oil drill pads, dry playa lakes or at the center of wide, shallow depressions. Leks may be completely bare, covered with short grass, or have scattered clumps of grass or short tufts of plants. An important physical requirement for location of leks is visibility of surroundings, but the most important consideration is proximity of suitable nesting habitat, breeding females and the ability to hear male vocalizations.

In the late 1980s, there were 35 documented active booming grounds known to exist within the CFO. Due to population decreases and unpredictable weather cycles the LPC is currently proposed for federal listing, and potentially may become extirpated from Eddy and southern Lea counties. The last documented sighting within the Carlsbad field office boundaries was on March 15^{th} 2011.

In June 1998, the US Fish and Wildlife Service (USFWS) issued a statement regarding their status review of the lesser prairie-chicken. It stated, "Protection of the lesser prairie-chicken under the Federal Endangered Species Act (ESA) is warranted but precluded which means that other species in greater need of protection must take priority in the listing process." Given the current Federal Candidate status of this species, the Bureau of Land Management is mandated to carry out management consistent with the principles of multiple use, for the conservation of candidate species and their habitats, and shall ensure that actions authorized, funded, or carried out do not contribute to the need to list any of these species as Threatened or Endangered (Bureau Manual 6840.06).

On December 11, 2012 the USFWS proposed to list the lesser prairie-chicken as a threatened species under the ESA of 1973, as amended. On March 27, 2014 the USFWS in response to the rapid and severe decline of the lesser prairie-chicken announced the final listing of the species as threatened under the ESA, as well as a final special rule under section 4(d) of the ESA that will limit regulatory impacts on landowners and business from the listing. Currently, the USFWS has not determined or designated critical habitat regarding the lesser prairie-chicken. The final rule to list the lesser prairie-chicken as threatened was published in the *Federal Register* on April 10, 2014, and will be effective on May 12, 2014. On July 20, 2016 the U.S. Fish and Wildlife Service formally removed the lesser prairie chicken from protection under the Endangered Species Act. Prescribed management for the species still follows BLM Resource Management Plan guidelines. On June 1, 2022 the USFWS published a proposed rule to list two distinct population segments (DPS) of the lesser prairie-chicken under the ESA.

3.5.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Impacts of the proposed action to wildlife in the localized area may include but are not limited to: possible mortality, habitat degradation and fragmentation, avoidance of habitat during construction and drilling activities and the potential loss of burrows and nests.

Standard practices and elements of the proposed action minimize these impacts to wildlife. These include: the NTL-RDO 93-1(modification of open-vent exhaust stacks to prevent perching and entry from birds and bats), nets on open top production tanks, interim reclamation, closed loop systems, exhaust mufflers, berming collection facilities, minimizing cut and fill, road placement, and avoidance of wildlife waters, stick nests, drainages, playas and dunal features. These practices reduce mortality to wildlife and allow habitat to be available in the immediate surrounding area thus reducing stressors on wildlife populations at a localized level.   Impacts to local wildlife populations are therefore expected to be minimal.

Special Status Species

Lesser Prairie-Chicken (Tympanuchus pallidicinctus)

Impacts of the proposed action to LPC in the localized area may include but are not limited to: disruptions in breeding cycles, habitat degradation and fragmentation, avoidance of habitat during construction and drilling activities and potential loss of nests. Noise and human activity generated from construction activity could impact the LPC by reducing the establishment of seasonal "booming grounds" or leks, thus possibly reducing reproductive success in the species. It is believed that the noise generated by construction activity and human presence could mask or disrupt the booming of the male prairie-chicken and thus inhibiting the females from hearing the booming. In turn, female LPC would not arrive at the booming ground, and subsequently, there would be decreased courtship interaction and possibly decreased reproduction. Decreased reproduction and the loss of recruitment into the local population would result in an absence of younger male LPC to replace mature male LPC once they expire, eventually causing the lek to disband and become inactive. Additionally, habitat fragmentation caused by development could possibly decrease the habitat available for nesting, brooding and feeding activities.

The CFO takes every precaution to ensure that active booming grounds and nesting habitats are protected by applying a timing and noise condition of approval within portions of suitable and occupied habitat for the LPC. It is not known at this time whether active booming grounds or nest locations are associated with this specific location. Only after survey efforts during the booming season are conducted, will it be known whether an active lek is in close proximity (within 1.5 miles) of the proposed location or not.

Exceptions to timing and noise requirements will be considered in emergency situations such as mechanical failures, however, these exceptions will not be granted if BLM determines, on the basis of biological data or other relevant facts or circumstances, that the grant of an exception would disrupt LPC booming activity during the breeding season. Requests for exceptions on a non-emergency basis may also be considered, but these exceptions will not be granted if BLM determines that there are prairie-chicken sightings, historic leks and or active leks within 1.5 miles of the proposed location, or any combination of the above mentioned criteria combined with suitable habitat.

In light of the circumstances under which exceptions may be granted, minimal impacts to the LPC are anticipated as a result of the grant of exceptions to the timing limitation for LPC Condition of Approval. On account of these requirements and mitigation measures as below, minimal impacts to the LPC are anticipated as a result of oil and gas activity. **This project is not likely to jeopardize the continued existence of this species.**

Raptors have been observed using plugged and abandoned well markers as perches. Artificial perches may increase raptor presences in a given area. Furthermore, artificial perches may provide strategically-located vantage points and may improve the hunting efficiency of raptors. In order to improve the probability of maintaining a stable lesser prairie-chicken population, low profile plugged and abandoned well markers will be installed. The well marker will be approximately two (2) inches above ground level and contain the following information: operator name, lease name, and well number and location, including unit letter, section, township, and range. The previous listed information will be welded, stamped, or otherwise permanently engraved into the metal of the marker.

Candidate Conservation Agreement

The proponent of the proposed action is a Participating Cooperator in the Candidate Conservation Agreement (CCA) for the lesser prairie-chicken (*Tympanuchus pallidicinctus*) and dunes sagebrush lizard (*Sceloporus arenicolus*).

The goal of the Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), Center of Excellence for Hazardous Materials Management (CEHMM) and the Participating Cooperator is to reduce and/or eliminate threats to the LPC and/ or SDL. By agreeing to conduct the conservation measures described by the CCA, the Participating Cooperator contributes funding or provides in-kind services for conservation.

The Certificate of Participation (CP) associate with the CCA is voluntary between CEHMM, BLM, USFWS and the Participating Cooperator. Through the CP, the Participating Cooperator voluntarily commits to implement or fund specific conservation actions that will reduce and/or eliminate threats to the SDL and /or the LPC. Funds contributed as part of the CP will be used to implement conservation measures and associated activities. The funds will be directed to the highest priority projects to restore or reclaim habitat at the sole discretion of BLM and USFWS.

The following Conservation Measures are to be accomplished in addition to those described in the CCA and Pecos District Special Status Species Resource Management Plan Amendment (RMPA):

1. To the extent determined by the BLM representative at the Plan of Development stage, all infrastructures supporting the development of a well (including roads, power lines, and pipelines) will be constructed within the same corridor.

2. On enrolled parcels that contain inactive wells, roads and/or facilities that are not reclaimed to current standards, the Participating Cooperator shall remediate and reclaim their facilities within three years of executing this CP, unless the Cooperator can demonstrate they will put the facilities back to beneficial use for the enrolled parcel(s). If an extension is requested by the Cooperator, they shall submit a detailed plan (including dates) and receive BLM approval prior to the three-year deadline. All remediation and reclamation shall be performed in accordance with BLM requirements and be approved in advance by the Authorized Officer.

3. Utilize alternative techniques to minimize new surface disturbance when required and as determined by the BLM representative at the Plan of Development stage.

4. Install fence markings along fences owned, controlled, or constructed by the Participating Cooperator that cross through occupied habitat within two miles of an active LPC lek.

5. Bury new powerlines that are within two (2) miles of LPC lek sites active at least once within the past five years (measured from the lek). The avoidance distance is subject to change based on new information received from peer reviewed science.

6. Bury new powerlines that are within one (1) mile of historic LPC lek sites where at least one LPC has been observed within the past three years (measured from the historic lek). The avoidance distance is subject to change based on new information received from peer reviewed science.

7. Management recommendations may be developed based on new information received from peer reviewed science to mitigate impacts from H2S and/or the accumulation of sulfates in the soil related to production of gas containing H2S on the LPC. Such management recommendations will be applied by the Participating Cooperator as Conservation Measures under this CI/CP in suitable and occupied SDL/LPC habitat where peer-reviewed science has shown that H2S levels threaten the LPC.

Mitigation Measures and Residual Impacts

In May 2008, the Pecos District Special Status Species Resource Management Plan Amendment (RMPA) was approved and is being implemented. In addition to the standard practices that minimize impacts, as listed above, the following COA will apply:

- Timing Limitation Stipulation / Condition of Approval for lesser prairie-chicken, to minimize noise associated impacts which could disrupt breeding and nesting activities.
- Upon abandonment, a low profile abandoned well marker will be installed to prevent raptor perching.

3.7. Vegetation

3.6.1. Affected Environment

Sandy Soil Type Plant Communities

Vegetation within this project area is dominated by warm season, short and midgrasses such as black grama, bush muhly, various dropseeds, and three-awns. Bluestems, bristlegrass, lovegrasses, and hooded windmillgrass make up some of the less common grasses. Shrubs include mesquite, shinnery oak, sand sagebrush, broom snakeweed, and yucca. A large variety of forbs occur and production fluctuates greatly from year to year, and season to season. Common forbs include bladderpod, dove weed, globemallow, annual buckwheat, and sunflower.

3.6.2. Impacts from the Proposed Action

Direct and Indirect Effects

Construction of the well pads, access roads, flowlines and electrical lines would remove about 11.2 acres of vegetation. This impact would last as long as the well is productive. However, interim reclamation, conducted within 6 months after a well is completed would reduce this area. When the well is plugged and abandoned, the rest of the pad would be reclaimed and potentially re-vegetate in 3-5 years, depending on timely rainfall. By using the proper seed mix (Seed Mixture #2/Sandy Sites), good seed bed preparation, and proper seeding techniques, this impact would be short term (two or three growing seasons).

Mitigation Measures

- Interim reclamation will be conducted on all disturbed areas not needed for active support of production operations, and if caliche is used as a surfacing material it will be removed at time of reclamation to enhance re-establishment of vegetation.
- Topsoil will be stockpiled to enhance reclamation.
- The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

3.8. Noxious Weeds and Invasive Plants

3.7.1 Affected Environment

There are four plant species within the CFO that are identified in the New Mexico Noxious Weed List Noxious Weed Management Act of 1998. These species are African rue, Malta starthistle, Russian olive, and salt cedar. African rue and Malta starthistle populations have been identified throughout the Carlsbad Field Office and mainly occur along the shoulders of highway, state and county roads, lease roads and well pads (especially abandoned well pads). The CFO has an active noxious weed monitoring and treatment program, and partners with county, state and federal agencies and industry to treat infested areas with chemical and monitor the counties for new infestations.

Currently there are no known populations of invasive, non-native species within the proposed project vicinity.

3.7.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Any surface disturbance could increase the possibility of establishment of new populations of invasive, non-native species. The construction of the proposed action may contribute to the establishment and spread of African rue and Malta starthistle. The main mechanism for seed dispersion would be by equipment and vehicles that were previously used and/or driven across noxious weed infested areas. Noxious weed seed could be carried to and from the project area by construction equipment and transport vehicles.

Mitigation Measures and Residual Impacts

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

3.9. Range

3.8.1. Affected Environment

The proposed action is within the Andrew Flats, allotment # 76051. This allotment is a yearlong cow-calf deferred rotation operation. Range improvement projects such as windmills, water delivery systems (pipelines, storage tanks, and water troughs), earthen reservoirs, fences, and brush control projects are located within the allotment, but not located near the project vicinity**..** In general, an average rating of the range land within this area is 6 acres per Animal Unit Month (AUM). In order to support one cow, for one year, about 72 acres are needed. This equals about nine cows per section.

3.8.2. Impacts from the Proposed Action

Direct and Indirect Effects

The loss of 11.2 acres of vegetation would not affect the AUMs authorized for livestock use in this area. There are occasional livestock injuries or deaths due to accidents such as collisions with vehicles, falling into excavations, and ingesting plastic or other materials present at the work site. If the fence is damaged or a gate left open during construction of the proposed action, cattle may cross from one pasture or allotment to another. This will disrupt any grazing plan in place and could cause a loss in time and money to gather, sort, and return cattle to the correct pasture. If the pipeline is damaged or destroyed, livestock will not be able to drink. This can stress, or ultimately, kill the livestock. If further development occurs, the resulting loss of vegetation could reduce the AUMs authorized for livestock use in this area.

Impacts to the ranching operation are reduced by standard practices such as utilizing existing surface disturbance, minimizing the well pad and access road total surface disturbance, utilizing steel tanks instead of reserve pits, minimizing vehicular use, placing parking and staging areas on caliche surfaced areas, reclaiming the areas not necessary for production, and quickly establishing vegetation on the reclaimed areas. Avoiding existing range improvement projects, or moving them, would prevent them from being damaged by the proposed action.

Mitigation Measures

Livestock Watering Requirement
Structures that provide water to livestock, such as windmills, pipelines, drinking troughs, and earthen reservoirs, will be avoided by moving the proposed action.

3.10. Visual Resource Management

3.9.1. Affected Environment

The Visual Resource Management (VRM) program identifies visual values, establishes objectives in the RMP for managing those values, and provides a means to evaluate proposed projects to ensure that visual management objectives are met.

This project occurs within a Visual Resource Management Class IV zone. The objective of VRM Class IV is to provide management for activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic landscape elements of color, form, line and texture.

3.9.2. Impacts from the Proposed Action

Direct and Indirect Effects

This project would cause some short term and long-term visual impacts to the natural landscape. Short term impacts would occur during construction operations and prior to interim reclamation. These include the presence of construction equipment vehicle traffic. However, interim reclamation, conducted within 6 months after well completion would reduce this area by recontouring and revegetating.

Long term impacts would be visible to the casual observer throughout the life of the well. These include the visual evidence of storage tanks, piping, pump jacks, pads and roads, which cause visible contrast to form, line, color, and texture. Removal of vegetation due to construction would expose bare soil lighter in color and smoother in texture than the surrounding vegetation. The surfacing of these areas with caliche materials would cause further contrasts. Those contrasts would be visible to visitors in the area.

After final abandonment and reclamation, the pad, road and associated surface infrastructure would be removed, reclaimed, recontoured and revegetated, thereby eliminating visual impacts.

Short and long term impacts are minimized by best management practices such as color selection, reducing cut and fill, screening facilities with natural features and vegetation, interim reclamation and contouring roads along natural changes in elevation.

Mitigation Measures

Above-ground structures including meter housing that are not subject to safety requirements are painted a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008).

3.11. Cultural and Historical Resources

3.10.1. Affected Environment

The project falls within the Southeastern New Mexico Archaeological Region. This region contains the following cultural/temporal periods: Paleoindian (ca. 11,500 – 7,000 B.C.), Archaic (ca. 6,000 B.C. – A.D. 500), Ceramic (ca. A.D. 500 – 1400), Post Formative Native American (ca. A.D. 1400 – present), and Historic Euro-American (ca. A.D. 1865 to present). Sites representing any or all of these periods are known to occur within the region. A more complete discussion can be found in *Permian Basin Research Design 2016-2026 Volume I: Archaeology and Native American Cultural Resource published in 2016 by* SWCA Environmental Consultants, Albuquerque, New Mexico.

Native American Religious Concerns
The BLM conducts Native American consultation regarding Traditional Cultural Places (TCP) and Sacred Sites during land-use planning and its associated environmental impact review. In addition, during the oil & gas lease sale process, Native American consultation is conducted to identify TCPs and sacred sites whose management, preservation, or use would be incompatible with oil and gas or other land-use authorizations. With regard to Traditional Cultural Properties, the BLM has very little knowledge of tribal sacred or traditional use sites, and these sites may not be apparent to archaeologists performing surveys in advance of construction.

3.10.2. Impacts from the Proposed Action

Direct and Indirect Effects

The project falls within the area covered by the Permian Basin Programmatic Agreement (PA). The Permian Basin PA is an optional method of compliance with Section 106 of the National Historic Preservation Act for energy related projects in a 39-quadrangle area of the Carlsbad Field Office. The PA is a form of off-site mitigation which allows industry to design projects to avoid known NRHP eligible cultural resources and to contribute to a mitigation fund in lieu of paying for additional archaeological inventory in this area that has received adequate previous survey. Funds received from the Permian Basin PA will be utilized to conduct archaeological research and outreach in Southeastern New Mexico. Research will include archaeological excavation of significant sites, predictive modeling, targeted research activities, as well as professional and public presentations on the results of the investigations.

The proponent chose to participate in the Permian Basin (23-5025) PA by planning to avoid all known NRHP eligible and potentially eligible cultural resources. The proponent has contributed funds commensurate to the undertaking into an account for offsite mitigation. Participation in the PA serves as mitigation for the effects of this project on cultural resources. If any human skeletal remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered at any time during construction, all construction activities shall halt and the BLM will be notified as soon as possible within 24 hours. Work shall not resume until a Notice to Proceed is issued by the BLM.

Mitigation Measures

There are no mitigation measures for this project, as currently proposed.

3.12. Paleontology

3.11.1 Affected Environment

Paleontological resources are any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth. Fossil remains may include bones, teeth, tracks, shells, leaves, imprints, and wood. Paleontological resources include not only the actual fossils but also the geological deposits that contain them and are recognized as nonrenewable scientific resources protected by federal statutes and policies.

The primary federal legislation for the protection and conservation of paleontological resources occurring on federally administered lands are the Paleontological Resources Preservation Act of 2009 (PRPA), the Federal Land Policy and Management Act of 1976 (FLPMA), and the National Environmental Policy Act of 1970 (NEPA). BLM has also developed policy guidelines for addressing potential impacts to paleontological resources (BLM, 1998a, b; 2008, 2009). In addition, paleontological resources on state trust lands are protected by state policy from unauthorized appropriation, damage, removal, or use.

The Potential Fossil Yield Classification (PFYC) is a tool that allows the BLM to predict the likelihood of a geologic unit to contain paleontological resources. The PFYC is based on a numeric system of 1-5, with PFYC 1 having little likelihood of containing paleontological resources, whereas a PFYC 5 value is a geologic unit that is known to contain abundant scientifically significant paleontological resources. The fossil resources of concern in this area are the remains of vertebrates, which include species of fish, amphibians, and mammals.

3.11.2 Impacts from the Proposed Action

Direct and Indirect Effects

Direct impacts would result in the immediate physical loss of scientifically significant fossils and their contextual data. Impacts indirectly associated with ground disturbance could subject fossils to damage or destruction from erosion, as well as creating improved access to the public and increased visibility, potentially resulting in unauthorized collection or vandalism. However, not all impacts of construction are detrimental to paleontology. Ground disturbance can reveal significant fossils that would otherwise remain buried and unavailable for scientific study. In this manner, ground disturbance can result in beneficial impacts. Such fossils can be collected properly and curated into the museum collection of a qualified repository making them available for scientific study and education.

The location of the proposed project is within a PFYC 2, where management concern in negligible. A pedestrian survey for paleontological resources was not necessary and there should be no impacts to paleontological resources.

Mitigation Measures

There are no mitigation measures for this project, as currently proposed.

3.13. Impacts from the No Action Alternative

The No Action Alternative is used as the baseline for comparison of environmental effects of the analyzed alternatives. Under the No Action Alternative, the proposed project would not be drilled, built or constructed and there would be no new direct or indirect impacts to natural or cultural resources from oil and gas production. The natural and cultural resources in the project area would continue to be managed under the current land and resource uses.

3.14. Cumulative Impacts

Cumulative impacts are the combined effect of past projects, specific planned projects, and other reasonably foreseeable future actions within the project study area to which oil and gas exploration and development may add incremental impacts. This includes all actions, not just oil and gas actions that may occur in the area including foreseeable non-federal actions.

The combination of all land use practices across a landscape has the potential to change the visual character, disrupt natural water flow and infiltration, disturb cultural sites, cause increases in greenhouse gas emissions, fragment wildlife habitat and contaminate groundwater. Cumulative impacts analysis to air quality, GHG emissions, water use and quality is included in Chapter 3, under sections 3.1 and 3.2. The likelihood of these impacts occurring is minimized through standard mitigation measures, special Conditions of Approval and ongoing monitoring studies.

All resources are expected to sustain some level of cumulative impacts over time, however these impacts fluctuate with the gradual abandonment and reclamation of wells. As new wells are being drilled, there are others being abandoned and reclaimed. As the oil field plays out, the cumulative impacts will lessen as more areas are reclaimed and less are developed.

4. SUPPORTING INFORMATION

4.1. List of Preparers

Prepared by: Brooke Wilson,
Natural Resource Specialist
Drill Site Consulting

Date: 7/28/2022

The following individuals aided in the preparation of this document:

Jeffery Robertson, Natural Resource Specialist, BLM CFO
Aaron Whaley, Archaeologist, BLM-CFO
Scott P Lerich, Wildlife Biologist, BLM-CFO
Amanda Eavenson, Hydrologist, BLM-CFO
Sharay Dixon, Air Resource Specialist, BLM-NMSO
David Herrell, Hydrologist, BLM-NMSO

4.2. References

Applied Enviro Solutions (AES). 2011. Southeast New Mexico Inventory of Air Pollutant Emissions and Cumulative Air Impact Analysis 2007. BLM. Carlsbad Field Office.

Bohannon, Paul 2009. The RCRA Exploration & Production Exemption. http://bohannonlegal.com/pauls-oil-gas-manual-the-rcra-ep-exemption/

Bureau of Land Management (BLM). (2018). Air Resources Technical Report for Oil and Gas Development, New Mexico, Oklahoma, Texas and Kansas.

Bureau of Land Management (BLM). (2019).*Cumulative BLM New Mexico Greenhouse Gas Emissions, A Supplemental White Paper*.

Bureau of Land Management (BLM). (2019). Personal communication between David Herrell, BLM and Julie Valdez, NMOSE regarding water use associated with the Navajo Power Plant.

Dieter, C.A., Maupin, M.A., Caldwell, R.R., Harris, M.A., Ivahnenko, T.I., Lovelace, J.K., Barber, N.L., and Linsey, K.S., 2018, Estimated use of water in the United States in 2015: U.S. Geological Survey Circular 1441, 65 p. Report and dataset available at. https://pubs.er.usgs.gov/publication/cir1441. Downloaded April 1. 2019.

Engler, T. 2013. Response to comments on the DEIS for the Ocho Mine Project. Socorro, NM, USA. November 16.

Engler, T.W., and M. Cather. 2012. Reasonable Foreseeable Development (RFD) Scenario for the BLM. New Mexico Pecos District. Final Report. New Mexico Institute of Mining and Technology. Available at: https://eplanning.blm.gov/epl-front-office/projects/lup/64444/77502/86228/Final_Report-BLM-NMT-RFD.pdf. January 2019.

Environmental Protection Agency. 2013. The Green Book Non Attainment Areas for Criteria Pollutants. http://www.epa.gov/airquality/greenbk/ (Accessed 3/15/2013).

Environmental Protection Agency. 2013. 2005 National-Scale Air Toxics Assessment. Summary of Results. http://www.epa.gov/ttn/atw/nata2005.

Environmental Protection Agency. 2013. Air Trends: Design Values. http://www.epa.gov/airtrends/values.html.

Environmental Protection Agency. 2018. *National Ambient Air Quality Standards (NAAQS)*. Retrieved from U.S. Environmental Protection Agency: https://www.epa.gov/criteria-air-pollutants/naaqs-table

Fletcher, S. M. 2012. Risk Assessment of Groundwater Contamination from Hydraulic Fracturing Fluid Spills in Pennsylvania. Thesis (S.M. in Technology and Policy)--Massachusetts Institute of Technology, Engineering Systems Division, Technology and Policy Program. http://hdl.handle.net/1721.1/72885.

Fitzgerald LA, Painter CW, Sias DS, Snell HL (1997) The range, distribution, and habitat of Sceloporus arenicolus in New Mexico: final report submitted to the New Mexico Department of Game and Fish (Contract #80-516.6-01).

FracFocus. 2017.. Retrieved from FracFocus Data Download. Dataset available for download at the following: http://fracfocus.org/data-download. Downloaded December 13, 2018.

FracFocus. 2018.. Retrieved from FracFocus Data Download. Dataset available for download at the following: http://fracfocus.org/data-download. Downloaded January 28, 2019.

Gallegos, T.J., and Varela, B.A. 2015. Trends in hydraulic fracturing distributions and treatment fluids, additives, proppants, and water volumes applied to wells drilled in the United States from 1947 through 2010—Data analysis and comparison to the literature: U.S. Geological Survey Scientific Investigations Report 2014–5131, 15 p., http://dx.doi.org/10.3133/sir20145131. Accessed February 2019.

Groundwater Protection Council (GWPC). 2009. Modern Shale Gas Development in the United States: A Primer. Prepared for the U.S. Department of Energy, Office of Fossil Energy, and National Energy Technology Laboratory (NETL). DE-FG26-04NT15455. Oklahoma City, OK. http://www.netl.doe.gov/technologies/oilgas/publications/epreports/shale_gas_primer_2009.pdf.

Mire, K., and Moomaw, J. (2017) Delaware Basin: Seven Year Review of Activity and Performance. Unconventional Resources Technology Conference, Austin, Texas, pp 24-26. Available at:

https://library.seg.org/doi/abs/10.15530/urtec-2017-2697549#.XRYtE_cvHC0.email

NOAA. 2011. NOAA's 1981-2010 Climate Normals. National Climatic Center. http://www.ncdc.noaa.gov/oa/climate/normals/usnormals.html. (Accessed July 1, 2011).

Railey, J. A. 2016
Permian Basin Research Design 2016-2026 Volume I: Archaeology and Native American Cultural Resources. SWCA Environmental Consultants, Albuquerque, New Mexico.

SENM. 2014. Update to the Reasonable Foreseeable Development (RFD) for the BLM Pecos District, SENM. Final Report. New Mexico Institute of Mining and Technology. Available at: https://eplanning.blm.gov/epl-front-office/projects/lup/64444/80056/93025/Final_Report-SENM-DEC2014_updated_RFD.pdf

USDI. BLM. 2013. Air Resources Technical Report for Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas. New Mexico State Office.

Wenzel, C. 2012. A Case Study—Hydraulic Fracturing Geography: The Case of the Eagle Ford Shale, TX, USA. Thesis (M.S.)--Texas State University-San Marcos, Department of Geography. https://digital.library.txstate.edu/handle/10877/4247.
Texas. New Mexico State Office.